

PROJECT MANUAL for

TOWN OF FARMVILLE

Farmville Fire Station

6101 May Boulevard
Farmville NC 27828

BID DOCUMENTS
6/17/2025

DKA Project Number 2015



DAVIS KANE
ARCHITECTS, PA

503-300 Oberlin Road
Raleigh, North Carolina 27605

Phone (919) 833-3737
Fax (919) 755-1771

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NOT USED

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Town of Farmville

**Town of Farmville
Fire Station & Headquarters**

Bid Documents

June 17, 2025

OWNER

TOWN OF FARMVILLE
Farmville, North Carolina

ARCHITECT

DAVIS KANE ARCHITECTS, PA
Raleigh, North Carolina



CIVIL ENGINEER/
LANDSCAPE ARCHITECT

CLH DESIGN, PA
Cary, North Carolina



Digitally signed by Steven Miller
Date: 2025.06.12 16:02:54-04'00'

STRUCTURAL
ENGINEER

IMEG CONSULTANTS, CORPORATION
Raleigh, North Carolina



FP/ P. M. E. ENGINEER

IMEG CONSULTANTS, CORPORATION
Raleigh, North Carolina



DOCUMENT 000115 - LIST OF DRAWING SHEETS

1.1 LIST OF DRAWINGS

- A. Drawings: Drawings consist of the Contract Drawings and other drawings listed on the Table of Contents page of the separately bound drawing set titled TOWN OF FARMVILLE FIRE STATION & HEADQUARTERS, dated December 11, 2023, as modified by subsequent Addenda and Contract modifications.

List of Drawings: Drawings consist of the following Contract Drawings and other drawings of type indicated:

TITLE

G001 TITLE SHEET
G002 CODE SUMMARY
G003 CODE SUMMARY
G004 LIFE SAFETY PLANS
G005 UL DETAILS

CIVIL

C000 COVER SHEET
C100 SITE STAKING PLAN
C200 EXISTING CONDITIONS/DEMO PLAN
C300 SITE GRADING PLAN
C400 EROSION & SEDIMENT CONTROL PLAN – INTIAL INSTALL
C401 EROSION & SEDIMENT CONTROL PLAN
C500 SITE UTILITY PLAN
C600 LANDSCAPE PLAN
C701 EROSION & SEDIMENT CONTROL DETAILS
C702 EROSION & SEDIEMNT CONTROL DETAILS
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C705 WETLAND DETAILS
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C802 STORM & UTILITY DETAILS
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C901 STAKING DETAILS
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A002 PARTITION LEGEND
A100 FIRST FLOOR PLAN
A110 FIRST FLOOR RCP
A111 MEZZANINE LEVEL PLANS
A120 ROOF PLAN
A200 BUILDING ELEVATIONS
A300 BUILDING SECTIONS
A301 WALL SECTIONS
A302 WALL SECTIONS

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A311	SECTION DETAILS
A312	PLAN DETAILS, TYPICAL DETAILS
A313	CANOPY & CEILING DETAILS
A314	ROOF DETAILS
A315	ROOF DETAILS
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A318	ROOF DETAILS – ALT 01
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A600	CASEWORK DETAILS
A700	DOOR SCHEDULE AND NOTES
A701	DOOR DETAILS
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A703	FENSTRATION DETAILS

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I001	TILE SYSTEMS AND DETAILS
I100	FIRST FLOOR FINISHES PLAN
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STRUCTURAL

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S002	GENERAL NOTES
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S101	FOUNDATION PLAN
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S501	TYPICAL DETAILS
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FP300	FIRE PROTECTION REFERENCE SECTIONS

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P200	FIRST FLOOR WATER PIPING PLAN
P300	PLUMBING FIXTURE SCHEDULE

P301 PLUMBING FIXTURE SCHEDULE
P400 PLUMBING DETAILS
P401 PLUMBING DETAILS
P402 PENETRATION DETAILS
P500 WASTE PIPING RISER

MECHANICAL

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M100 MECHANICAL PLAN
M101 MEZZANINE MECHANICAL PLAN
M102 GAS PIPING PLAN
M200 MECHANICAL SCHEDULES
M201 MECHANICAL DETAILS
M202 GAS RISER
M300 SAFEAIR INFORMATION
M301 SAFEAIR INFORMATION (CONT.)

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E100 LIGHTING PLAN
E101 POWER PLAN
E102 ELECTRICAL SITE PLAN
E200 POWER RISER FIXTURE SCHEDULE EQUIPMENT LIST
E201 PANEL SCHEDULES
E202 DETAILS

SPRINKLER ALARM

SA001 SPRINKLER ALARM LEGEND, RISER, BDA SYSTEM
SA100 SPRINKLER ALARM PLAN AND DETAIL

END OF DOCUMENT 000115

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ADVERTISEMENT FOR BIDS

Sealed proposals will be received until 2:00pm on July 16, 2025, at **Upstairs Courtroom in the Farmville Municipal Building - 3672 North Main Street, Farmville, NC 27828**, for the construction of **Farmville Fire Station and Headquarters**. This project will be bid and awarded in accordance with North Carolina law. Sealed proposals from single prime contractors will be received until 2:00 p.m. All bids will be opened and read aloud starting at 2:00 p.m. All times are local prevailing times.

A Pre-Bid Conference will be held on Monday, June 30, 2025, at 11:00AM, in the Upstairs **Courtroom in the Farmville Municipal Building - 3672 North Main Street, Farmville, NC 27828**. Questions concerning the project shall be submitted via email to Devanshi Kesaria at dkesaria@daviskane.com latest by 5 pm on July 02, 2025.

Complete plans and specifications in electronic format may be obtained from Davis Kane Architects PA. (919) 719-2812 during normal office hours and in the plan rooms of Dodge Construction Network, ConstructConnect, and in East Coast Digital - Minority Plan Room Provider beginning June 18, 2025.

Bids may be hand carried or mailed to:

Cindy Thomas
Human Resources Officer/Executive Assistant - Town of Farmville

3672 North Main Street; P.O. Box 86
Farmville, North Carolina 27828
(Phone) 252-753-5774 (Fax) 252-753-2963

Hours of Operation:
Monday – Thursday: 7:30 AM – 5:30 PM
Friday – 8:00 AM – 12:00 PM

The Town of Farmville Government reserves the unqualified right to reject any and all proposals.

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NOTICE TO BIDDERS

Project: Town of Farmville Fire Station & Headquarters

Owner: Town of Farmville
3672 North Main Street, Farmville, NC 27828
Contact: Justin Oakes, Interim Town Manager / Planning Director
Phone: (252) 753-6720 E-mail: joakes@farmvillenc.gov

Architect: Davis Kane Architects, PA
503 Oberlin Road
Suite 300
Raleigh, NC 27605
Contact: Devanshi Kesaria, Project Manager
Phone: 919.719.2812
E-mail: dkesaria@daviskane.com

Sealed Bids will be received until 2:00 PM, July 16, 2025, in the Upstairs Courtroom at the Farmville Municipal Building - 3672 North Main Street, Farmville, NC 27828 at which time and place Bids will be publicly opened and read aloud for the construction of the Town of Farmville Fire Station & Headquarters project.

After Bids are opened, the Owner shall evaluate them in accordance with the methods and criteria set forth in the Instructions to Bidders. The Owner/City Council reserves the right to waive any informality or to reject any or all Bids. Unless all Bids are rejected, Award will be made to the lowest responsible, responsive Bidder, taking into consideration quality, performance and the time specified in the proposals for the performance of the Contract. No bid may be withdrawn for sixty (60) days after the scheduled bid closing.

The Project consists of the following major items:

The project site is located at 6101 May Boulevard, Farmville, North Carolina. The Project consists of a new fire station to include five apparatus bays for the Town of Farmville. The site works consists of, but is not limited to, grading, finish grading, landscaping, filling and backfilling, connection of utilities, paver, parking areas, reinforced concrete fire truck aprons in and around the station, and concrete sidewalks. The fire station building consists of, but is not limited to, CMU block, brick masonry, metal studs, gypsum board, concrete, structural steel framing, standing seam metal roofing, aluminum storefront and window systems, ceramic tile, resilient flooring, acoustical ceiling tile, mechanical systems, electrical systems, plumbing systems, and fire sprinkler.

Pre-Bid Meeting

An open mandatory pre-bid meeting will be held for all interested bidders on June 30, 2025, at 11:00am in the **Upstairs Courtroom in the Farmville Municipal Building - 3672 North Main Street, Farmville, NC 27828**. The meeting will address project specific questions, issues, bidding procedures and bid forms.

Complete plans, specifications and contract documents will be electronically distributed by Davis Kane Architects to qualified General Contractors. No bid deposit is required for the electronically distributed documents. General Contractors should send an email to dkesaria@daviskane.com to be placed on the bidder's list and to receive a link to the documents. The documents will also be provided for posting on the plan rooms of the local North Carolina offices of Dodge Construction Network, ConstructConnect, and in East Coast Digital - Minority Plan Room Provider beginning June 18, 2025.

All contractors are hereby notified that they must have a proper license as required under the NC state

laws governing their respective trades.

NOTE: The bidder shall include with the bid proposal the form *Identification of Minority Business Participation* identifying the minority business participation it will use on the project and shall include either *Affidavit A* or *Affidavit B* as applicable. Forms and instructions are included within the Proposal Form in the bid documents. Failure to complete these forms is grounds for rejection of the bid. (GS143-128.2c Effective 1/1/2002.)

General contractors are notified that Chapter 87, Article 1, General Statutes of North Carolina, will be observed in receiving and awarding general contracts. General contractors submitting bids on this project must have license classification for General Contractor.

NOTE--SINGLE PRIME CONTRACTS: Under GS 87-1, a contractor that superintends or manages construction of any building, highway, public utility, grading, structure or improvement shall be deemed a "general contractor" and shall be so licensed. Therefore, a single prime project that involves other trades will require the single prime contractor to hold a proper General Contractors license.

EXCEPT: On public buildings being bid single prime, where the total value of the general construction does not exceed 25% of the total construction value, contractors under GS87- Arts 2 and 4 (Plumbing, Mechanical & Electrical) may bid and contract directly with the Owner as the SINGLE PRIME CONTRACTOR and may subcontract to other properly licensed trades. [GS87-1.1- Rules .0210](#)

Each proposal shall be accompanied by a cash deposit or a certified check drawn on some bank or trust company, insured by the Federal Deposit Insurance Corporation, of an amount equal to not less than five percent (5%) of the proposal, or in lieu thereof a bidder may offer a bid bond of five percent (5%) of the bid executed by a surety company licensed under the laws of North Carolina to execute the contract in accordance with the bid bond. Said deposit shall be retained by the owner as liquidated damages in event of failure of the successful bidder to execute the contract within ten days after the award or to give satisfactory surety as required by law.

A performance bond and a payment bond will be required for one hundred percent (100%) of the contract price.

Payment will be made based on ninety-five percent (95%) of monthly estimates and final payment made upon completion and acceptance of work.

No bid may be withdrawn after the scheduled closing time for the receipt of bids for a period of 60 days unless in accordance with G.S. 143-129-1.

The owner reserves the right to reject any or all bids and to waive informalities.

Designer:

Davis Kane Architects

(Name)

503 Oberlin Road, Raleigh, NC 27605

(Address)

919-833-3737

(Phone)

Owner:

Town of Farmville

(Agency/Institution)

3672 N Main Street, Farmville, NC 27828

252-753-6720

END OF DOCUMENT



Geotechnical Engineering Report

**Farmville Fire Station and Head Quarters
Farmville, Pitt County, North Carolina**

November 30, 2021

Terracon Project No. 72205105



Prepared for:

Davis Kane Architects PA
Raleigh, NC

Prepared by:

Terracon Consultants, Inc.
Greenville, North Carolina



November 30, 2021



Davis Kane Architects PA
503 Oberlin Road, Suite
Raleigh, NC 28202

Attn: Mr. Jimmy Edwards, AIA NCARB - Principal
P: (919) 719-2805
E: jedwards@daviskane.com

Re: Geotechnical Engineering Report
Farmville Fire Station and Head Quarters
6101 May Boulevard
Farmville, Pitt County, North Carolina
Terracon Project No. 72205105

Dear Mr. Edwards:

We have completed Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. P72205105 dated October 2, 2021. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations and pavements for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,

Terracon Consultants, Inc.

Branson Rogers
Staff Professional
Geotechnical Services

Andrew J. Gliniak, PE
Geotechnical Project Engineer
Registered NC 042183

James D. Hoskins, III, PE
Office Manager (Greensboro)

REPORT TOPICS

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Note: This report was originally delivered in a web-based format. **Orange Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the **GeoReport** logo will bring you back to this page. For more interactive features, please view your project online at client.terracon.com.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES
PHOTOGRAPHY LOG
SITE LOCATION AND EXPLORATION PLANS
EXPLORATION RESULTS
SUPPORTING INFORMATION

Note: Refer to each individual Attachment for a listing of contents.

REPORT SUMMARY

Topic ¹	Overview Statement ²
Project Description	The site is to be improved with an approximately 16,500 square foot fire station, associated asphalt/concrete drive and parking areas, and a stormwater management pond.
Geotechnical Characterization	The subsurface exploration at the test locations encountered fill, very loose to medium dense soil with some denser soil at locations B-9, B-10, and B-11 at a depth of approximately 10 feet. Sand fill was encountered at locations B-1, B-2, B-3, B-5, B-9, B-11, B-12, and B-13 to depths of 1 foot to 2.5 feet. The fill encountered was silty sand (SM) and clayey sand (SC). Groundwater is anticipated at depths of 5 feet to 8 feet below the existing ground surface.
Geotechnical Overview	Shallow foundations can be used for the anticipated design loads of the new buildings with recommended Earthwork . Isolated foundation over excavation and replacement to remove softer and looser surface soil such as those encountered in location B-13 to depths up to 5 feet should be anticipated. The fill encountered during our exploration appears suitable for foundation, floor slab, and pavement support after the recommended Earthwork . Support of pavements on or above these existing fill soils, is discussed in this report.
Earthwork	After stripping, the exposed subgrade soils in the building and pavement footprints should be densified in place using a medium weight vibratory roller. The purpose of the vibratory rolling is to densify the exposed subgrade soils for floor slab and pavement support and to potentially improve the foundation bearing soils. Any existing utilities such as the existing drainage pipe should be removed prior to Earthwork .
Canopy Foundations	Allowable bearing pressure = 2,000 psf Expected settlements: < 1-inch total, < ½ -inch differential
Pavements	With subgrade prepared as noted in Earthwork , the minimum pavement sections include: Concrete: <ul style="list-style-type: none"> ■ 5 inches Portland Cement Concrete (PCC) in Light-Duty areas ■ 7.5 inches Portland Cement Concrete (PCC) in Heavy-Duty areas Asphalt: <ul style="list-style-type: none"> ■ 3 inches Asphaltic Concrete (AC) over 6 inches granular base in Light-Duty areas ■ 4.5 inches AC over 8 inches granular base in Heavy-Duty areas
General Comments	This section contains important information about the limitations of this geotechnical engineering report.

1. If the reader is reviewing this report as a pdf, the topics above can be used to access the appropriate section of the report by simply clicking on the topic itself.

2. This summary is for convenience only. It should be used in conjunction with the entire report for design purposes.

Geotechnical Engineering Report
Farmville Fire Station and Head Quarters
6101 May Boulevard
Farmville, Pitt County, North Carolina
Terracon Project No. 72205105
November 30, 2021

INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed facility to be located at 6101 May Boulevard in Farmville, Pitt County, North Carolina. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Stormwater pond considerations
- Seismic site classification per IBC
- Foundation design and construction
- Site preparation and earthwork
- Pavement design and construction\
- Seasonal High-Water Table and Infiltration Rates

The geotechnical engineering Scope of Services for this project included the advancement of 12 soundings to depths ranging from approximately 5 to 35 feet below existing site grades including macrocore samples taken at B-1, B-5, B-11, B-12, B-13.

Maps showing the site and boring locations are shown in the **Site Location** and **Exploration Plan** sections, respectively. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring logs and as separate graphs in the **Exploration Results** section.

SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project is located at 6101 May Boulevard in Farmville, Pitt County, North Carolina. Approximately 2.4 acres See Site Location and Exploration Plan
Coordinates	35.2696°N, 77.6711°W (approximate)

Geotechnical Engineering Report

Farmville Fire Station and Head Quarters ■ Farmville, Pitt County, North Carolina
November 30, 2021 ■ Terracon Project No. 72205105



Item	Description
Existing Improvements	The site was improved with a single-story warehouse/manufacturing facility with associated parking and driveways. The building has since been demolished. An existing storm pipe also bisects the parcel.
Current Ground Cover	Grass and trees.
Existing Topography	Gently sloping from the south to the north portion of the site with elevations ranging from 73 feet to 65 feet MSL based on Google Earth.
Geology	<p>The subject site is located in the Coastal Plain Physiographic Province. The Coastal Plain soils consist mainly of marine sediments that were deposited during successive periods of fluctuating sea level and moving shoreline. The soils include sands, silts, and clays with irregular deposits of shells, which are typical of a shallow sloping sea bottom. Recent alluvial sands, silts, and clays are typically present near rivers and creeks.</p> <p>According to USGS Mineral Resources On-Line Spatial Data based on the 1998 digital equivalent of the 1985 Geologic Map of North Carolina updated in 1998, within the Yorktown Formation and Duplin Formation.</p>

We also collected photographs at the time of our field exploration program. Representative photos are provided in our [Photography Log](#).

PROJECT DESCRIPTION

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Information Provided	Email communication with survey plans provided on September 28, 2020 and a site plan was provided on September 22, 2021. A kickoff meeting to discuss the project scope was held on October 28, 2021.
Project Description	The site is to be improved with an approximately 16,500 square foot fire station, associated asphalt and concrete drive and parking areas, and a stormwater management pond.
Proposed Structure	The structure will be a steel framed single-story building with CMU walls.
Finished Floor Elevation	70.75 feet
Maximum Loads	<ul style="list-style-type: none">■ Columns: Up to 50 kips■ Walls: 3 kips per linear foot (klf)■ Slabs: 100 pounds per square foot (psf)■ Apparatus bay slabs: 60 kips per truck axle

Geotechnical Engineering Report

Farmville Fire Station and Head Quarters ■ Farmville, Pitt County, North Carolina
November 30, 2021 ■ Terracon Project No. 72205105



Item	Description
Grading/Slopes	Up to 5 feet of cut and/or fill placement is anticipated for the majority of the site.
Pavements	We assume both rigid (concrete) and flexible (asphalt) pavement sections will be considered. The anticipated traffic loads were provided by the client. The pavement design period is 20 years.
Estimated Start of Construction	Winter 2022

GEOTECHNICAL CHARACTERIZATION

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of site preparation and foundation options. Conditions encountered at each exploration point are indicated on the individual logs. The individual logs can be found in the **Exploration Results** section and the GeoModel can be found in the **Figures** section of this report.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the GeoModel.

Model Layer	Layer Name	General Description
1	Fill	Sand fill. Gravel was encountered in boring B-2
2	Looser Soil	Very loose to medium dense soil.
3	Denser Soil	Medium dense to dense soil.

Fill was encountered at locations B-1, B-2, B-3, B-5, B-9, B-11, B-12, and B-13. The fill encountered was silty sand (SM) and clayey sand (SC). There was gravel found at location B-2 at a depth of 3 feet to 3.5 feet when hand auguring for a bulk sample.

Groundwater

Groundwater was measured between 5 feet and 8 feet at the test locations during our field exploration. Based on measured water depths at the soundings, CPT data, and moisture condition of the soil samples, groundwater is anticipated at depths of 5 feet to 8 feet below the existing ground surface.

The groundwater level can change due to seasonal variations in the amount of rainfall, runoff, lower permeability of the soil, and other factors not evident at the time the borings were performed. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

Seasonal High Water Table (SHWT)

The seasonal high water table (SHWT) and infiltration testing at the requested locations will be conducted at a later date. The accompanying report will be provided as an addendum to this report.

GEOTECHNICAL OVERVIEW

The subsurface exploration at the test locations encountered fill, very loose to medium dense soil throughout the site with some denser soil at locations B-9, B-10, and B-11 at approximately 10 feet. Isolated foundation over excavation and replacement to remove softer and looser surface soil such as those encountered in location B-13 to depths up to 5 feet should be anticipated. Portions of the subgrade are moisture sensitive, and if possible, grading should be performed during the warmer and drier times of the year. If grading is performed during the winter months, an increased risk for possible undercutting and replacement of unstable subgrade will persist. Additional site preparation recommendations, including subgrade improvement and fill placement, are provided in the **Earthwork** section. Any abandoned utilities such as the existing drain line should be removed before performing any of the earthwork.

The fill encountered during our exploration appears suitable for foundation, floor slab, and pavement support after the recommended **Earthwork**. However, there is an inherent risk for the owner that compressible fill or unsuitable material within or buried by the fill. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill but can be reduced by following the recommendations contained in this report.

After stripping topsoil, the exposed subgrade soils in the building and pavement footprints should be densified in place using a medium weight vibratory roller. The purpose of the rolling is to densify the exposed subgrade soils for floor slab and pavement support and to potentially improve the foundation bearing soils.

Following the recommended **Earthwork**, the building can be supported on shallow foundations bearing on approved existing soils or structural fill compacted as recommended and sized for a maximum net allowable soil bearing pressure of 2,000 psf.

The **General Comments** section provides an understanding of the report limitations.

EARTHWORK

Earthwork is anticipated to include clearing and grubbing, excavations and fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the

state considered in our geotechnical engineering evaluation for foundations, floor slabs, and pavements. Grading for the structure should incorporate the limits of the proposed structure plus 5 feet beyond proposed perimeter building walls and any exterior columns.

Site Preparation

Site preparation should begin with the complete removal of surface vegetation, trees, and topsoil in the proposed building footprint and pavement areas. The existing drainage pipe should also be removed. Low ground pressure or tracked equipment could be required due to the relatively loose near surface conditions. Based on site observations during the drilling process, topsoil should be stripped up to a depth of approximately 3 inches to 4 inches. The Geotechnical Engineer should field verify the stripping depth and existing fill material suitability during construction. Topsoil may be reused in areas of the site to be landscaped but should not be used as structural fill or backfill.

After stripping and removing topsoil, the exposed subgrade soils in the building and pavement footprints should be densified in place using a medium weight vibratory roller. The purpose of the vibratory rolling is to densify the exposed subgrade soils for floor slab and pavement support and to potentially improve the foundation bearing soils. The roller should make at least six passes across the site, with the second set of three passes perpendicular to the first set of three passes. If water is brought to the surface by the vibratory rolling, the operation should be discontinued until the water subsides. Vibratory rolling should be completed during dry weather. Static rolling and additional repairs should be anticipated for areas too wet for vibratory rolling.

After the vibratory rolling, pore pressures should be allowed to dissipate for a minimum of 16 hours. After the waiting period, proofrolling should be performed on the exposed subgrade soils in areas to receive fill or at the subgrade elevation with a fully loaded, tandem-axle dump truck (20-ton minimum) or similar rubber-tired construction equipment. Proofrolling is recommended as a means of detecting areas of soft or unstable subgrade soils. The proofrolling should be performed during a period of dry weather to avoid degrading an otherwise suitable subgrade. The proofrolling operations should be observed by a representative of the geotechnical engineer. Subgrade soils that exhibit excessive rutting or deflection during proofrolling should be repaired as directed by the field representative. Typical repairs include overexcavation followed by replacement with either properly compacted fill or by a subgrade stabilization fabric in conjunction with a sand fill or crushed stone.

Existing Fill

As noted in **Geotechnical Characterization**, existing fill is present at the site. Support of pavements, on or above additional existing fill soils could be considered if the subgrade withstands proofrolling and consists of acceptable materials as determined during **Earthwork**. However, there is inherent risk for the owner that compressible fill or unsuitable material, within or buried by the fill, will not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill but can be reduced by following the recommendations contained in this report.

Utility Abandonment

Special precautions should be made to remove all underground utilities and their associated backfill as the proposed structure's foundations may overlay these materials. Terracon considers removing the utilities and underground structures and backfilling the resulting trenches to be the preferred method of abandonment. In-place abandonment by filling piping with grout should only be considered in the building footprint after checking the location of the piping in both plan and elevation space for potential conflict with the proposed foundations, construction, and new utilities. Care should be given to locating and addressing these items during the site preparation phase of the project. If overlooked, they could be detrimental to the long-term performance of the structure.

Fill Material Types

Fill required to achieve design grade should be classified as structural fill and general fill. Structural fill is material used below, or within 5 feet of structures or constructed slopes. General fill is material used to achieve grade outside of these areas. Earthen materials used for structural and general fill should meet the following material property requirements:

Soil Type ¹	USCS Classification	Acceptable Parameters (for Structural Fill)
Imported Soil	SC, SM, SP	All location and elevations.
On-Site Soils	SC, SM, SP	On site soils that meet these soil classifications are generally suitable for fill if properly moisture conditioned.

1. Structural and general fill should consist of approved materials free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to use on this site.

Clay soils are not recommended for use as structural fill due to their high fines content, existing wet condition, and moisture sensitivity relative to the sandy soils that are available.

Fill Compaction Requirements

Structural and general fill should meet the following compaction requirements.

Item	Structural Fill	General Fill
Maximum Lift Thickness	9 inches or less in loose thickness when heavy, self-propelled compaction equipment is used 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is used	Same as Structural fill
Minimum Compaction Requirements ^{1, 2, 3}	98% of maximum within 1 foot of finished subgrade 95% maximum below foundations and more than 1 foot below finished subgrade	92% of maximum
Water Content Range ¹	-2% to +2% of optimum	As required to achieve min. compaction requirements

1. Fill should be tested for moisture content and compaction during placement. If in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the tests should be reworked and retested as required until the specified moisture and compaction requirements are achieved.
2. It is not necessary to achieve 95% compaction on the existing ground prior to placing fill or beginning construction. However, the subgrade should be evaluated by a representative of the geotechnical engineer prior to placing fill or beginning construction.
3. Maximum density and optimum water content as determined by the standard Proctor test (ASTM D 698).

It is important to note that the use of rubber-tired traffic, such as lulls, may impact the prepared subgrade soils leading to re-grading. We recommend that the use of rubber-tired traffic be limited on the prepared subgrades or that the stabilized area be prepared for their travel.

Earthwork Construction Considerations

Shallow excavations for the proposed structure are anticipated to be accomplished with conventional construction equipment. Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of floor slabs. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Water collecting over or adjacent to construction areas should be removed. If the subgrade freezes, desiccates, saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted prior to floor slab construction.

Groundwater encountered in excavations should be pumped out from sumps or well points if applicable. Pumping water, as required, should continue until excavations are completely backfilled.

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As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, "Excavations" and its appendices, and in accordance with any applicable local, and/or state regulations.

Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety, or the contractor's activities; such responsibility shall neither be implied nor inferred.

Construction Observation and Testing

The earthwork efforts should be monitored under the direction of the Geotechnical Engineer. Monitoring should include documentation of adequate removal of vegetation and topsoil, proofrolling, and mitigation of areas delineated by the proofroll to require mitigation.

Each lift of compacted fill should be tested, evaluated, and reworked, as necessary, until approved by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content at a frequency of at least one test for every 2,500 square feet of compacted fill in the building areas and 5,000 square feet in pavement areas. One density and water content test should be performed for every 50 linear feet of compacted utility trench backfill.

In areas of foundation excavations, the bearing subgrade should be evaluated under the direction of the Geotechnical Engineer. If unanticipated conditions are encountered, the Geotechnical Engineer should prescribe mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions, including assessing variations and associated design changes.

SHALLOW FOUNDATIONS

If the site has been prepared in accordance with the requirements noted in **Earthwork**, the following design parameters are applicable for the canopy foundations.

Design Parameters – Compressive Loads

Item	Description
Maximum Net allowable bearing pressure ¹	2,000 psf
The required embedment below lowest adjacent finished grade for frost protection and protective embedment ²	12 inches
Minimum width for continuous wall footings	12 inches for thickened slab 16 inches for strip footings
Minimum width for isolated column footings	24 inches
Approximate total settlement ³	Up to 1 inch
Estimated differential settlement ³	Up to ½ inch between columns and along 40 feet of wall
Ultimate coefficient of sliding friction ⁴	0.35

1. The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. The maximum net allowable bearing pressure may be increased by 1/3 for temporary wind loads.
2. For frost protection and to reduce effects of seasonal moisture variations in subgrade soils. For perimeter footings and footings beneath unheated areas.
3. The actual magnitude of settlement that will occur beneath the foundations will depend upon the variations within the subsurface soil profile, the structural loading conditions and the quality of the foundation excavation. The estimated total and differential settlements listed assume that the foundation-related earthwork and the foundation design are completed in accordance with our recommendations.
4. For uplift resistance, use the weight of the foundation concrete plus the weight of the soil over the plan area of the footings. 110 pounds per cubic foot should be used for the density of the soil.

Foundation Construction Considerations

The foundation bearing materials should be evaluated at the time of the foundation excavation. This is an essential part of the construction process. A representative of the geotechnical engineer should use a combination of hand auger borings and dynamic cone penetrometer (DCP) testing to determine the suitability of the bearing materials for the design bearing pressure. DCP testing should be performed to a depth of 3 to 5 feet below the bottom of foundation excavation. Excessively soft, loose, or wet bearing soils should be over excavated to a depth recommended by the geotechnical engineer. The excavated soils should be replaced with structural fill or washed, crushed stone (NCDOT No. 57) wrapped in a geotextile fabric (Mirafi 140 N or equivalent). The need for the

geotextile fabric with the crushed stone should be determined by the Geotechnical Engineer during construction based on sloughing/caving soils and excavation observations. However, footings could bear directly on the soils after over excavation if approved by the Geotechnical Engineer.

The base of all foundation excavations should be free of water and loose soil prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Should the soils at bearing level become excessively disturbed or saturated, the affected soil should be removed prior to placing concrete.

SEISMIC CONSIDERATIONS

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Site Classification is required to determine the Seismic Design Category for a structure. The Site Classification is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7 and the International Building Code (IBC). Based on the soil properties encountered at the site and as described on the exploration logs and results, it is our professional opinion that the **Seismic Site Classification is D**. Subsurface explorations at this site were extended to a maximum depth of 35 feet. The site properties below the boring depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth.

LIQUEFACTION

Based on the results of the borings, liquefaction is not expected based on the relatively low level of ground motions associated with the design earthquake and density of the soils.

FLOOR SLABS

Design parameters for floor slabs assume the requirements for **Earthwork** have been followed. Specific attention should be given to positive drainage away from the structure and positive drainage of the aggregate base beneath the floor slab. Rigid pavement sections should be used for the apparatus bay areas of the fire station.

Floor Slab Design Parameters

Item	Description
Floor slab support	Approved existing soil or structural fill.
Modulus of subgrade reaction	100 pounds per square inch per inch (psi/in) for point loading conditions.
Base Course	4 inches crushed stone (NCDOT ABC)

The use of a vapor retarder should be considered beneath concrete slabs on grade covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

Saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations, refer to the ACI Design Manual. Joints or cracks should be sealed with a water-proof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing or other means.

Settlement of floor slabs supported on existing fill materials cannot be accurately predicted, but could be larger than normal and result in some cracking. Mitigation measures, as noted in **Existing Fill** within **Earthwork**, are critical to the performance of floor slabs. In addition to the mitigation measures, the floor slab can be stiffened by adding steel reinforcement, grade beams and/or post-tensioned elements.

Floor Slab Construction Considerations

On most project sites, the site grading is generally accomplished early in the construction phase. However, as construction proceeds, the subgrade may be disturbed due to utility excavations, construction traffic, desiccation, rainfall, etc. As a result, the floor slab subgrade may not be suitable for placement of base stone and concrete and corrective action will be required to repair the damaged areas.

Finished subgrade, within and for at least 5 feet beyond the floor slab, should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or desiccated prior to construction of floor slabs, the affected material should be removed, and structural fill should be added to replace the

resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

The Geotechnical Engineer should approve the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel, and concrete. We recommend the area be thoroughly proofrolled. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

PAVEMENTS

Pavement thickness design is dependent upon the following:

- Anticipated traffic conditions during the life of the pavement.
- Subgrade and paving material characteristics.
- Climatic conditions of the region.

The provided traffic loads at the site will be produced primarily by vans, semi-trucks, and box trucks in the heavy-duty areas and by passenger cars and light delivery vehicles for the light duty areas. Two pavement section alternatives have been provided. The light-duty pavement sections are for car parking areas only. Heavy-duty pavement sections should be used for concentrated car traffic (drive lanes / entrance drives) and garbage/delivery truck traffic areas. We have assumed a 20-year design period and the following traffic volume:

Heavy-duty Areas	Light-duty Areas
<ul style="list-style-type: none">■ Up to 7 delivery trucks and garbage trucks per week■ Up to 6 firetrucks per day■ Up to 1 semi-truck per week	<ul style="list-style-type: none">■ 50 cars and pickups per day

A subgrade CBR of 4 was selected for design pavement sections based upon our experience with similar near surface subgrade soils and our understanding of the quality of the subgrade as prescribed by the **Site Preparation** conditions as outlined in **Earthwork**. CBR testing results will be provided at a later date.

Pavement Section Thicknesses

For areas subject to concentrated and repetitive loading conditions, i.e. dumpster pads and ingress/egress aprons, or in areas where vehicles will turn at low speeds, we recommend using a Portland cement concrete pavement with a thickness of at least 7.5 inches underlain by at least 4 inches of crushed stone. For dumpster pads, the concrete pavement area should be large enough to support the container and tipping axle of the refuse truck. The following table provides options for general AC and PCC Sections:

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Recommended Minimum Pavement Sections			
Pavement Type	Material	Layer Thickness (inches)	
		Light Duty	Heavy Duty
Portland Cement Concrete (PCC)/ Rigid	Portland Cement Concrete (4,000 psi)	5	7.5
	Crushed Aggregate Base Course (NCDOT ABC)	4 ¹	
Asphaltic Concrete (AC)/ Flexible (Superpave)	Asphalt Surface (NCDOT S9.5B)	3 ²	1.5
	Asphalt Binder (NCDOT I19.0C)	---	3.0
	Crushed Aggregate Base Course (NCDOT ABC)	6	8

1. Crushed Aggregate Base Course is recommended for construction purposes. Concrete could be placed directly on an approved subgrade. However, stormwater can quickly degrade exposed subgrades without the crushed aggregate base course leading to additional subgrade repairs.

2. Placed in two equal lift thicknesses (1.5 inches).

For subgrade instability that could develop due to the weather. We recommend that contingencies be placed in the budget for a geosynthetic and addition stone. The geosynthetic could be left off corridors/easements for deeper utility lines for ease of construction.

The placement of a partial pavement thickness for use during construction is not suggested without a detailed pavement analysis incorporating construction traffic. In addition, we should be contacted to confirm the traffic assumptions outlined above. If the actual traffic varies from the assumptions outlined above, modification of the pavement section thickness could be required.

Recommendations for pavement construction presented depend upon compliance with recommended material specifications. To assess compliance, observation and testing should be performed under the direction of the geotechnical engineer.

Asphalt concrete and aggregate base course materials should conform to the North Carolina Department of Transportation (NCDOT) "Standard Specifications for Roads and Structures". Concrete pavement materials should conform to ACI 330.1 "Specifications for Unreinforced Parking Lots". Concrete pavement should be air-entrained and have a minimum compressive strength of 4,000 psi after 28 days of laboratory curing per ASTM C-31. ACI 330R-01 recommendations should be followed concerning control and expansion joints, as well as other concrete pavement practices.

Pavement Maintenance

The pavement sections represent minimum recommended thicknesses and, as such, periodic maintenance should be anticipated. Therefore, preventive maintenance should be planned and provided for through an on-going pavement management program. Maintenance activities are intended to slow the rate of pavement deterioration and to preserve the pavement investment. Maintenance consists of both localized maintenance (e.g., crack and joint sealing and patching) and global maintenance (e.g., surface sealing). Preventive maintenance is usually the priority when implementing a pavement maintenance program. Additional engineering observation is recommended to determine the type and extent of a cost-effective program. Even with periodic maintenance, some movements and related cracking may still occur, and repairs may be required.

Pavement performance is affected by its surroundings. In addition to providing preventive maintenance, the civil engineer should consider the following recommendations in the design and layout of pavements:

- Final grade adjacent to paved areas should slope down from the edges at a minimum 2%.
- Subgrade and pavement surfaces should have a minimum 2% slope to promote proper surface drainage.
- Install below pavement drainage systems surrounding areas anticipated for frequent wetting.
- Install joint sealant and seal cracks immediately.
- Seal all landscaped areas in or adjacent to pavements to reduce moisture migration to subgrade soils.
- Place compacted, low permeability backfill against the exterior side of curb and gutter.
- Place curb, gutter and/or sidewalk directly on clay subgrade soils rather than on unbound granular base course materials.

GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of

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pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

FIGURES

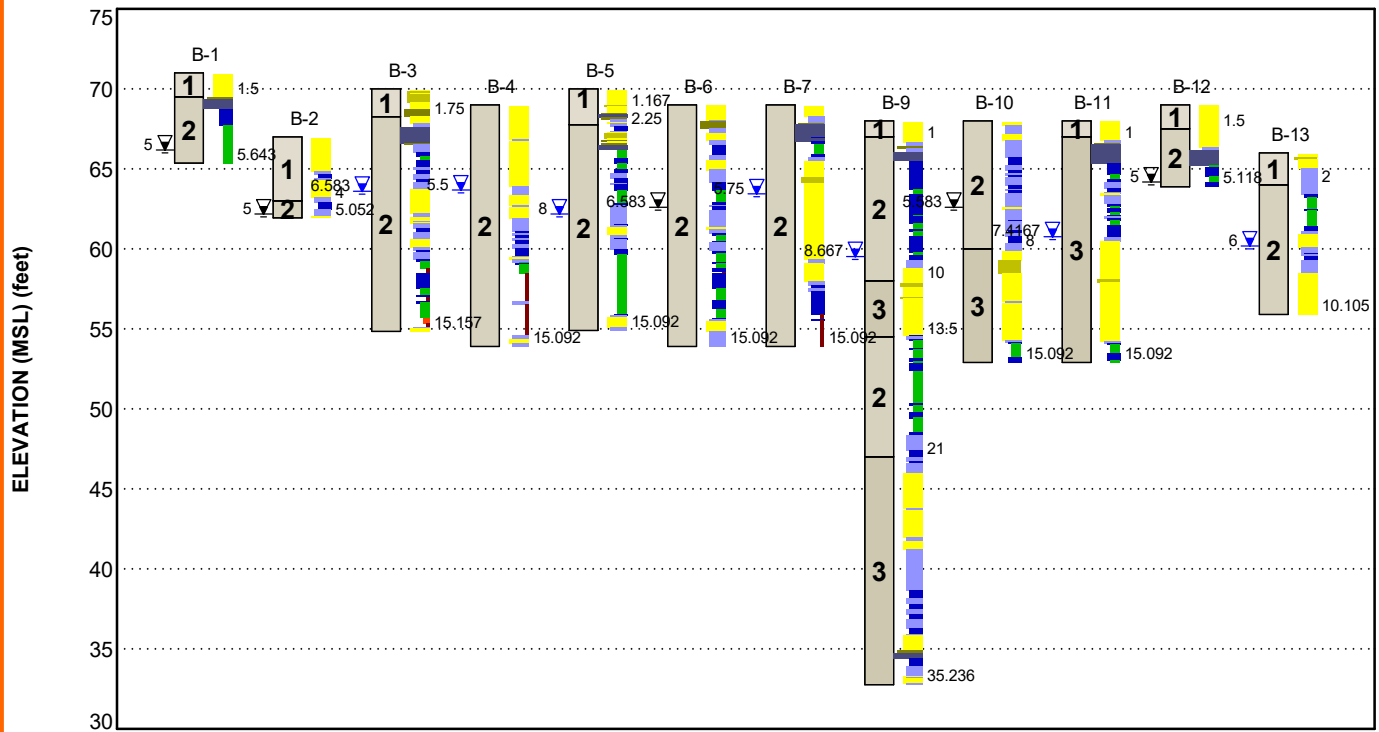
Contents:

GeoModel

Note: All attachments are one page unless noted above.

GEOMODEL

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This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	Fill	Sand fill. Gravel was encountered in boring B-2.
2	Looser Soil	Very loose to medium dense soil.
3	Denser Soil	Medium dense to dense soil.

LEGEND

Soil Behavior Type (SBT)

1 Sensitive, fine grained	2 Organic soils - clay	3 Clay - silty clay to clay
4 Silt mixtures - clayey silt to silty clay	5 Sand mixtures - silty sand to sandy silt	6 Sands - clean sand to silty sand
7 Gravelly sand to dense sand	8 Very stiff sand to clayey sand	9 Very stiff fine grained

▽ CPT Assumed Water Depth

▽ CPT Water Depth

NOTES:

Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project. Numbers adjacent to soil column indicate depth below ground surface.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES

Field Exploration

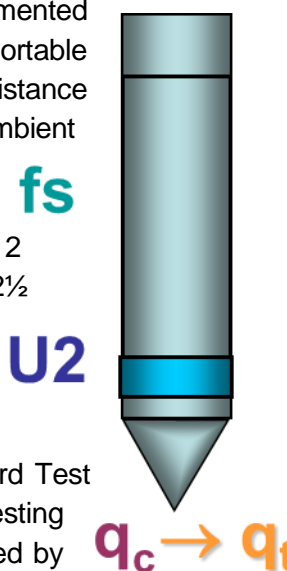
Number of Tests	Depth (feet) ¹	Location
Three (B-1, B-2, B-12)	5	Planned parking/driveway areas
Seven (B-3, B-4, B-5, B-6, B-7, B-10, B-11)	15	Planned building area
One (SCPT, B-9)	35	Planned building area
One (B-13)	10	Planned stormwater management area

1. Below existing ground surface.

Layout and Elevations: Coordinates of the soil test locations were determined by overlaying the plans provided on aerial photography by referencing common features. The test locations were marked in the field by Terracon by referencing existing site features and a handheld GPS unit (estimated horizontal accuracy of about ± 20 feet). The location of the test locations should be considered accurate only to the degree implied by the means and methods used to define it.

Subsurface Exploration Procedures: The subsurface exploration was performed by a track mounted power drilling rig utilizing cone penetration testing (CPT) to advance the borings. Samples taken during the drilling process were tagged for identification, sealed to reduce moisture loss, and taken to our laboratory for further examination, testing, and classification.

Cone Penetration Testing (CPT): The CPT hydraulically pushes an instrumented cone through the soil while nearly continuous readings are recorded to a portable computer. The cone is equipped with electronic load cells to measure tip resistance and sleeve resistance and a pressure transducer to measure the generated ambient pore pressure. The face of the cone has an apex angle of 60° and an area of 10 cm^2 . Digital data representing the tip resistance, friction resistance, pore water pressure, and probe inclination angle are recorded about every 2 centimeters while advancing through the ground at a rate between $1\frac{1}{2}$ and $2\frac{1}{2}$ centimeters per second. These measurements are correlated to various soil properties used for geotechnical design. No soil samples are gathered through this subsurface investigation technique.



CPT testing is conducted in general accordance with ASTM D5778 "Standard Test Method for Performing Electronic Friction Cone and Piezocone Penetration Testing of Soils." Upon completion, the data collected was downloaded and processed by the project engineer.

Seismic Piezocone Penetration Test (SCPT) Testing: SCPT is identical to the CPT test with added instrumentation to determine the shear wave velocity with depth. This additional information was collected via an accelerometer placed above the instrumented cone. A shear wave is generated at the ground surface, such as a hammer striking a steel plate on the end, which propagates through the soil and is recorded by the accelerometer beginning at a depth of 6 feet and at selected intervals (typically 4 feet) thereafter. From this data, the interval shear wave velocities of the soil are calculated. These interval velocities are used to develop the shear wave velocity profile for the site. Soil shear wave velocity data is used in evaluation of liquefaction potential, site class determination, site specific analyses, and other geotechnical design applications.

Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests to understand the engineering properties of the various soil strata, as necessary, for this project. Procedural standards noted below are for reference to methodology in general. In some cases, variations to methods were applied because of local practice or professional judgment. Standards noted below include reference to other, related standards. Such references are not necessarily applicable to describe the specific test performed.

- ASTM D2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- ASTM D2487 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
- ASTM D2488 Standard Practice of Description and Identification of Soils (Visual Manual Method)
- ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM D422 Standard Test Method for Particle-Size Analysis of Soils
- ASTM D1140 Standard Test Methods for Determining the Amount of Material Finer than No. 200 Sieve in Soils by Washing

The laboratory testing program often included examination of soil samples by an engineer. Based on the material's texture and plasticity, we described and classified the soil samples in accordance with the Unified Soil Classification System.

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PHOTOGRAPHY LOG

Photos taken October 11, 2021



View of site facing SW



View of site facing NW

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View of site facing SW

SITE LOCATION AND EXPLORATION PLANS

Contents:

Site Location Plan

Exploration Plan

Note: All attachments are one page unless noted above.

SITE LOCATION

Farmville Fire Station ■ Farmville, NC

November 30, 2021 ■ Terracon Project No. 72205105

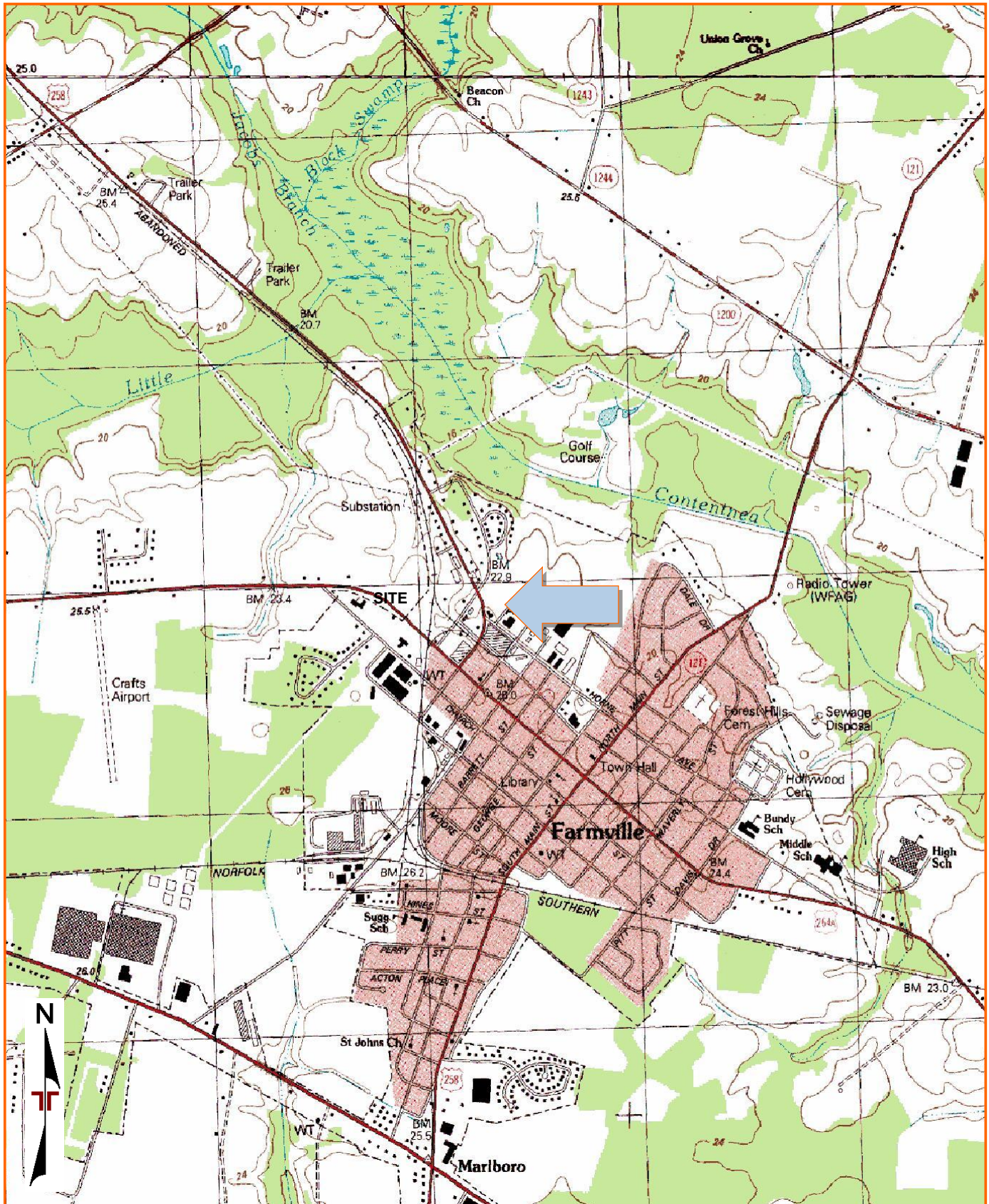


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS
NOT INTENDED FOR CONSTRUCTION PURPOSES

TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGICAL SURVEY
QUADRANGLES INCLUDE: FALKLAND, NC (1/1/1997) and FARMVILLE, NC (1/1/1981).

EXPLORATION PLAN

Farmville Fire Station ■ Farmville, NC

November 30, 2021 ■ Terracon Project No. 72205105

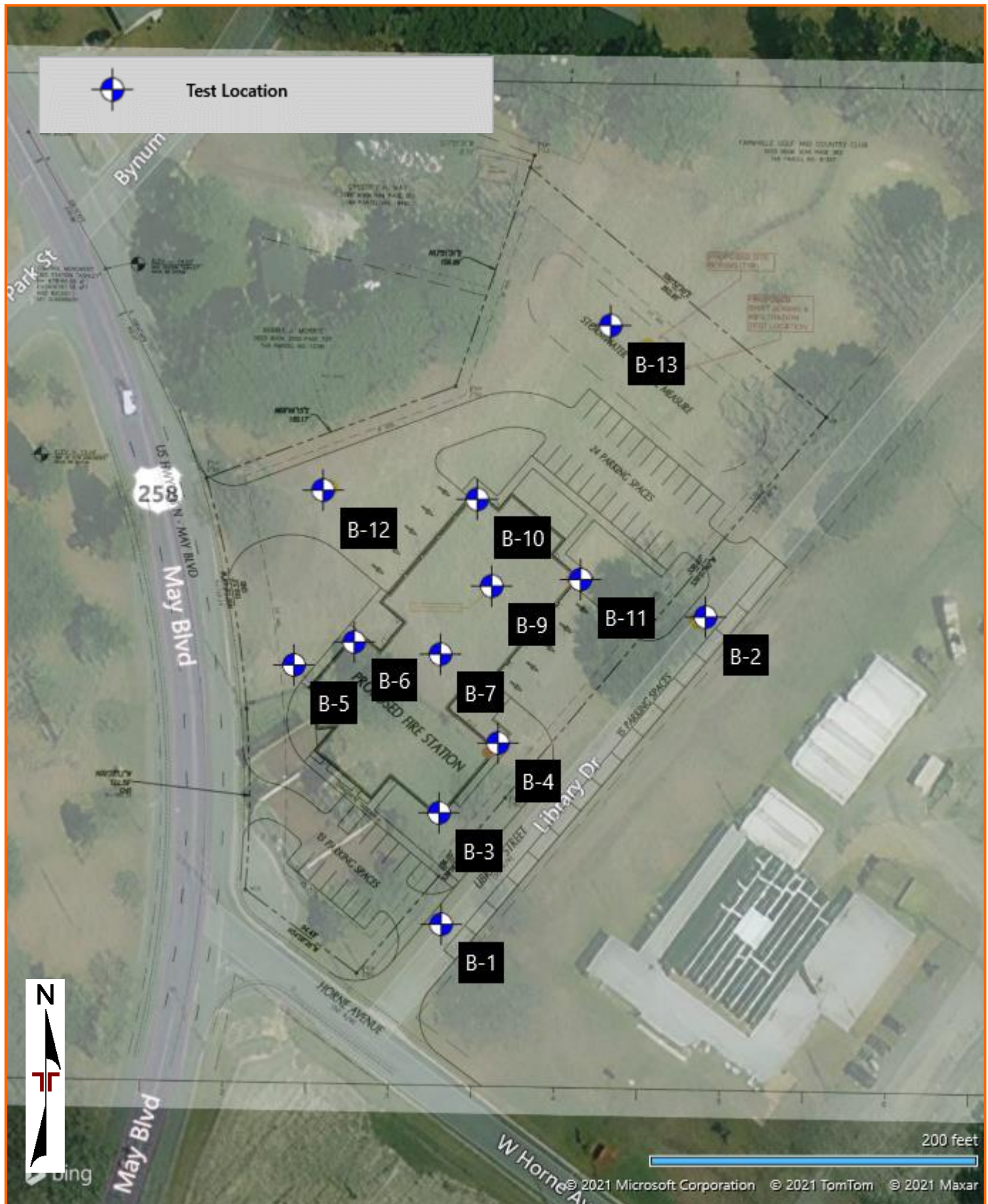


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

EXPLORATION RESULTS

Contents:

Exploration Logs (B-1 through B-7, B-9 through B-13)

Grain Size Distribution

Atterberg Limits

Note: All attachments are one page unless noted above.

CPT LOG NO. B-1

Page 1 of 1

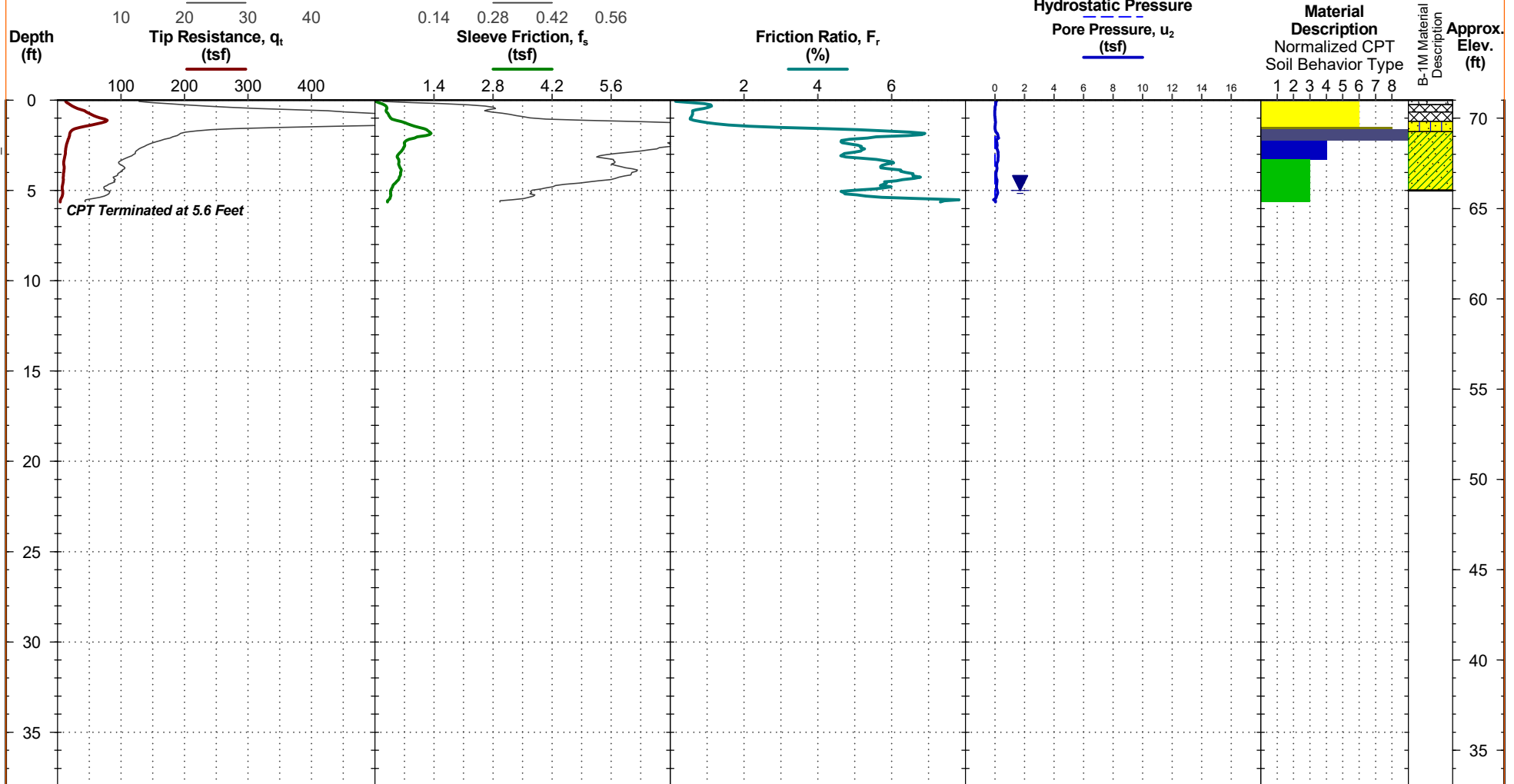
PROJECT: Farmville Fire Station

CLIENT: Davis Kane Architects PA
Raleigh, NC

TEST LOCATION: See [Exploration Plan](#)

SITE: 6101 May Blvd.
Farmville, NC

Approx. Surface Elev: 71 ft +/- Adjacent Test: B-1M
Latitude: 35.6033719200008°
Longitude: -77.5900211034166°



Cave in depth= 5.0 feet

Topsoil = 2 inches

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

Elevations were interpolated from a topographic site plan.

See B-1M for the adjacent test's full details.

Dead weight of rig used as reaction force.

CPT sensor calibration reports available upon request.

- 1 Sensitive, fine grained
- 2 Organic soils - clay
- 3 Clay - silty clay to clay
- 4 Silt mixtures - clayey silt to silty clay
- 5 Sand mixtures - silty sand to sandy silt
- 6 Sands - clean sand to silty sand
- 7 Gravelly sand to dense sand
- 8 Very stiff sand to clayey sand
- 9 Very stiff fine grained

WATER LEVEL OBSERVATION

5 ft estimated water depth
(used in normalizations and correlations;
See [Supporting Information](#))

Probe no. 5143 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 2/1/2019
Tip and sleeve areas of 10 cm² and 150 cm²
Ring friction reducer with O.D. of 1.875 in

Terracon
314 Beacon Dr
Winterville, NC

CPT Started: 10/26/2021

Rig: Geoprobe

Project No.: 72205105

CPT Completed: 10/26/2021

Operator: RDU

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. CPT REPORT 72205105 FARMVILLE FIRE ST.GPJ TERRACON_DATATEMPLATE.GDT 11/24/21

BORING LOG NO. B-1M

Page 1 of 1

PROJECT: Farmville Fire Station

CLIENT: Davis Kane Architects PA
Raleigh, NC

SITE: 6101 May Blvd.
Farmville, NC

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.6034° Longitude: -77.5900° Approximate Surface Elev.: 71 (Ft.) +/- ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		DEPTH						
		0.3 TOPSOIL , - 3 inches	71+/-					
1		0.7 FILL - SILTY SAND , brown	70.5+/-					
		1.2 FILL - CLAYEY SAND , trace gravel, brown	70+/-			7.8		
		1.8 SILTY SAND (SM) , trace sand, brown	69.5+/-					
2		SANDY LEAN CLAY (CL) , trace organics, brown with orange/red				28.2	49-18-31	63
		5.0 Boring Terminated at 5 Feet	66+/-			20.7		

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Direct Push

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).


Notes:

Abandonment Method:

See [Supporting Information](#) for explanation of symbols and abbreviations.

WATER LEVEL OBSERVATIONS

See CPT log

 Cave in

Terracon

314 Beacon Dr
Winterville, NC

Boring Started: 10-26-2021

Boring Completed: 10-26-2021

Drill Rig: Geoprobe

Driller: RDU

Project No.: 72205105

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 72205105 FARMVILLE FIRE ST.GPJ TERRACON_DATATEMPLATE.GDT 11/24/21

CPT LOG NO. B-2

Page 1 of 1

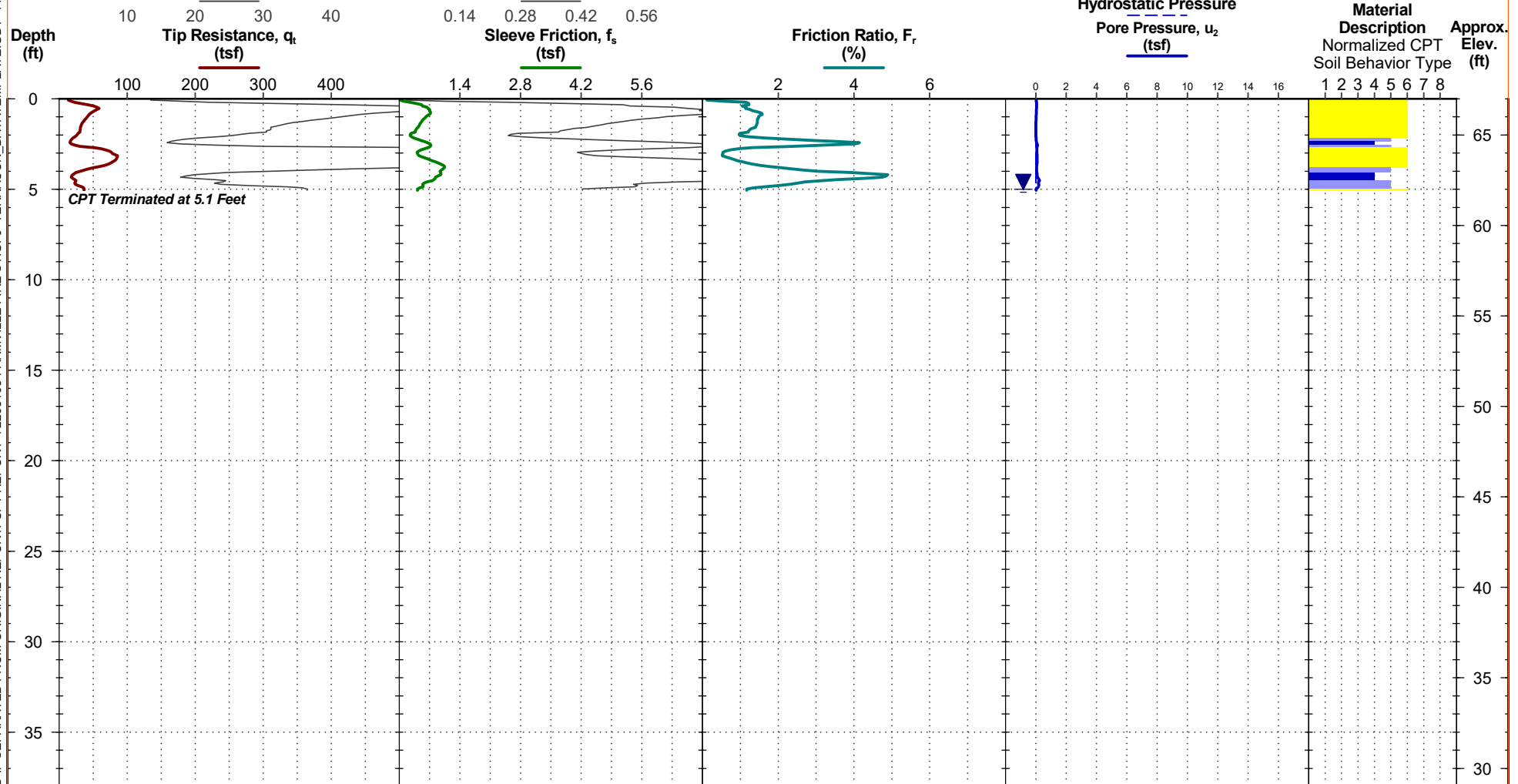
PROJECT: Farmville Fire Station

CLIENT: Davis Kane Architects PA
Raleigh, NC

TEST LOCATION: See [Exploration Plan](#)

SITE: 6101 May Blvd.
Farmville, NC

Approx. Surface Elev: 67 ft +/-
Latitude: 35.6038858560789°
Longitude: -77.5894770190618°



Cave in depth= 5.0 feet

Topsoil = 2 inches

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

Dead weight of rig used as reaction force.

CPT sensor calibration reports available upon request.

- 1 Sensitive, fine grained
- 2 Organic soils - clay
- 3 Clay - silty clay to clay
- 4 Silt mixtures - clayey silt to silty clay
- 5 Sand mixtures - silty sand to sandy silt
- 6 Sands - clean sand to silty sand
- 7 Gravelly sand to dense sand
- 8 Very stiff sand to clayey sand
- 9 Very stiff fine grained

WATER LEVEL OBSERVATION

5 ft estimated water depth
(used in normalizations and correlations;
See [Supporting Information](#))

Probe no. 5143 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 2/1/2019
Tip and sleeve areas of 10 cm² and 150 cm²
Ring friction reducer with O.D. of 1.875 in

Terracon
314 Beacon Dr
Winterville, NC

CPT Started: 10/26/2021

Rig: Geoprobe

Project No.: 72205105

CPT Completed: 10/26/2021

Operator: RDU

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. CPT REPORT 72205105 FARMVILLE FIRE ST.GPJ TERRACON_DATATEMPLATE.GDT 11/24/21

CPT LOG NO. B-3

Page 1 of 1

PROJECT: Farmville Fire Station

CLIENT: Davis Kane Architects PA
Raleigh, NC

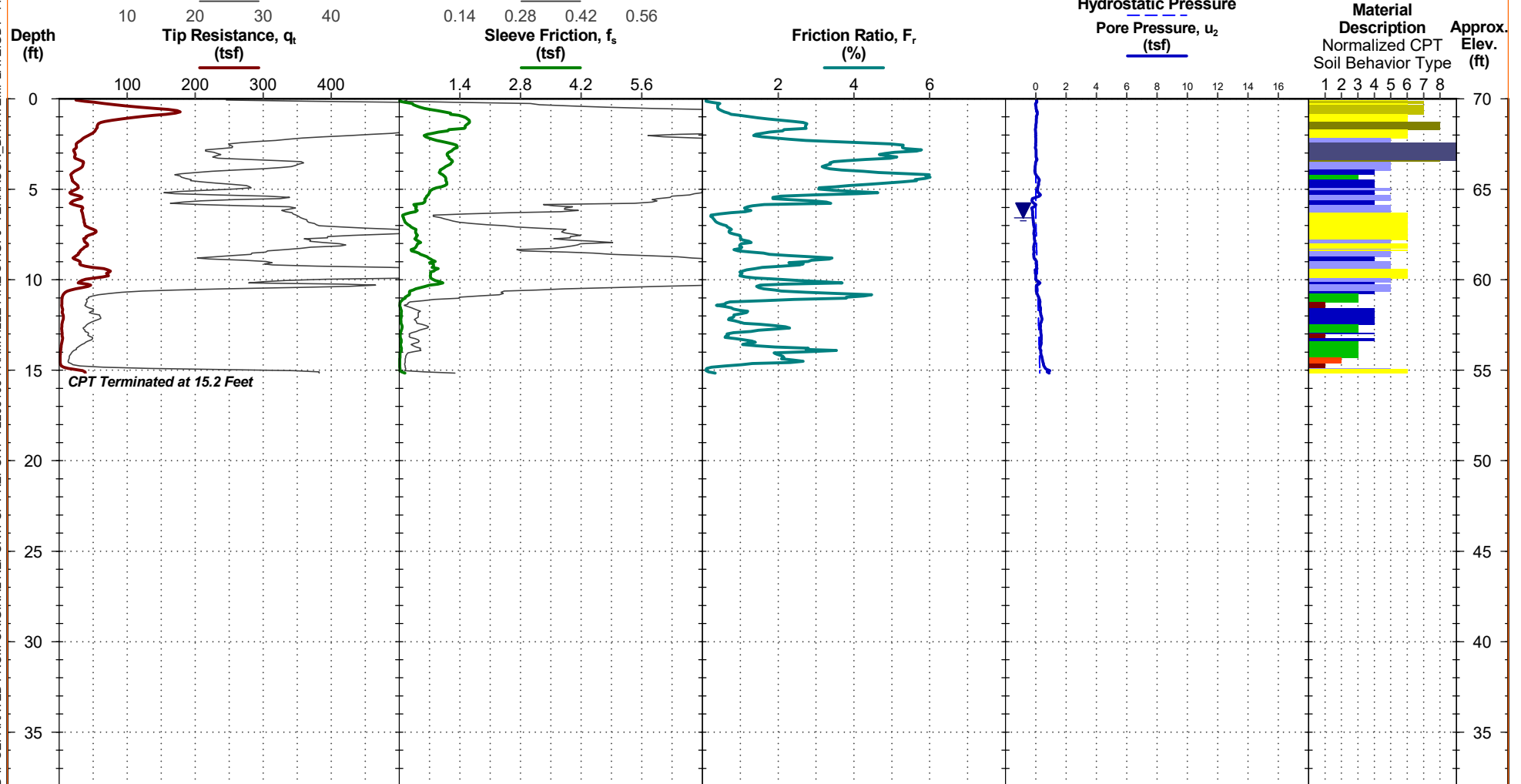
TEST LOCATION: See [Exploration Plan](#)

SITE: 6101 May Blvd.
Farmville, NC

Approx. Surface Elev: 70 ft +/-

Latitude: 35.6035584716993°

Longitude: -77.5900254419321°



Cave in depth= 8.1 feet

Topsoil = 2 inches

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

Auger anchors used as reaction force.

CPT sensor calibration reports available upon request.

- 1 Sensitive, fine grained
- 2 Organic soils - clay
- 3 Clay - silty clay to clay
- 4 Silt mixtures - clayey silt to silty clay
- 5 Sand mixtures - silty sand to sandy silt
- 6 Sands - clean sand to silty sand
- 7 Gravelly sand to dense sand
- 8 Very stiff sand to clayey sand
- 9 Very stiff fine grained

WATER LEVEL OBSERVATION

6.583 ft measured water depth
(used in normalizations and correlations;
See [Supporting Information](#))

Probe no. 5143 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 2/1/2019
Tip and sleeve areas of 10 cm² and 150 cm²
Ring friction reducer with O.D. of 1.875 in

Terracon
314 Beacon Dr
Winterville, NC

CPT Started: 10/26/2021

Rig: Geoprobe

Project No.: 72205105

CPT Completed: 10/26/2021

Operator: RDU

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. CPT REPORT 72205105 FARMVILLE FIRE ST.GPJ TERRACON_DATATEMPLATE.GDT 11/24/21

CPT LOG NO. B-4

Page 1 of 1

PROJECT: Farmville Fire Station

CLIENT: Davis Kane Architects PA
Raleigh, NC

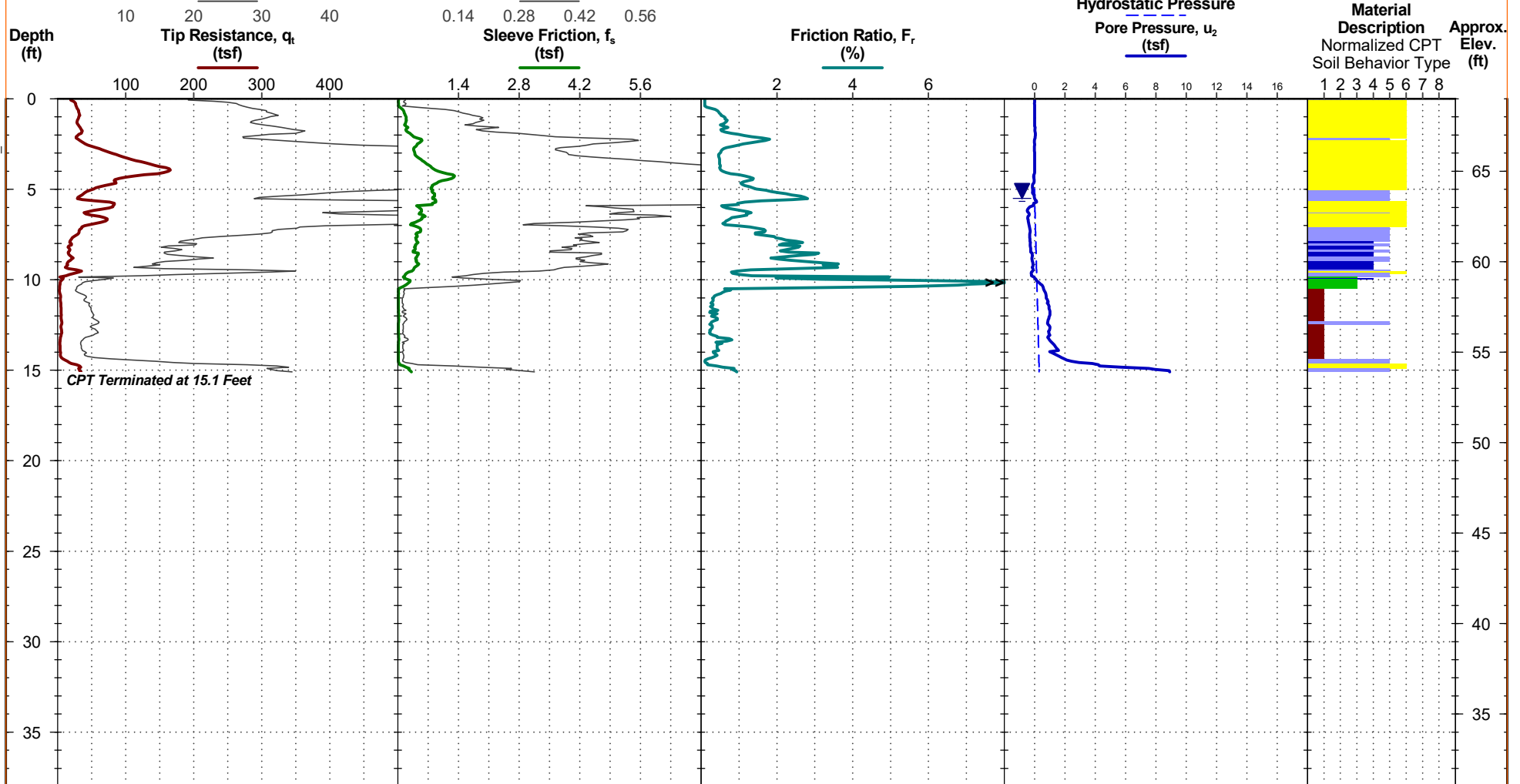
TEST LOCATION: See [Exploration Plan](#)

SITE: 6101 May Blvd.
Farmville, NC

Approx. Surface Elev: 69 ft +/-

Latitude: 35.6036751471426°

Longitude: -77.5899040370875°



Cave in depth= 7.6 feet

Topsoil = 2 inches

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

Auger anchors used as reaction force.

CPT sensor calibration reports available upon request.

- 1 Sensitive, fine grained
- 2 Organic soils - clay
- 3 Clay - silty clay to clay
- 4 Silt mixtures - clayey silt to silty clay
- 5 Sand mixtures - silty sand to sandy silt
- 6 Sands - clean sand to silty sand
- 7 Gravelly sand to dense sand
- 8 Very stiff sand to clayey sand
- 9 Very stiff fine grained

WATER LEVEL OBSERVATION

5.5 ft measured water depth
(used in normalizations and correlations;
See [Supporting Information](#))

Probe no. 5143 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 2/1/2019
Tip and sleeve areas of 10 cm² and 150 cm²
Ring friction reducer with O.D. of 1.875 in

Terracon
314 Beacon Dr
Winterville, NC

CPT Started: 10/26/2021

Rig: Geoprobe

Project No.: 72205105

CPT Completed: 10/26/2021

Operator: RDU

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. CPT REPORT 72205105 FARMVILLE FIRE ST.GPJ TERRACON_DATATEMPLATE.GDT 11/24/21

CPT LOG NO. B-5

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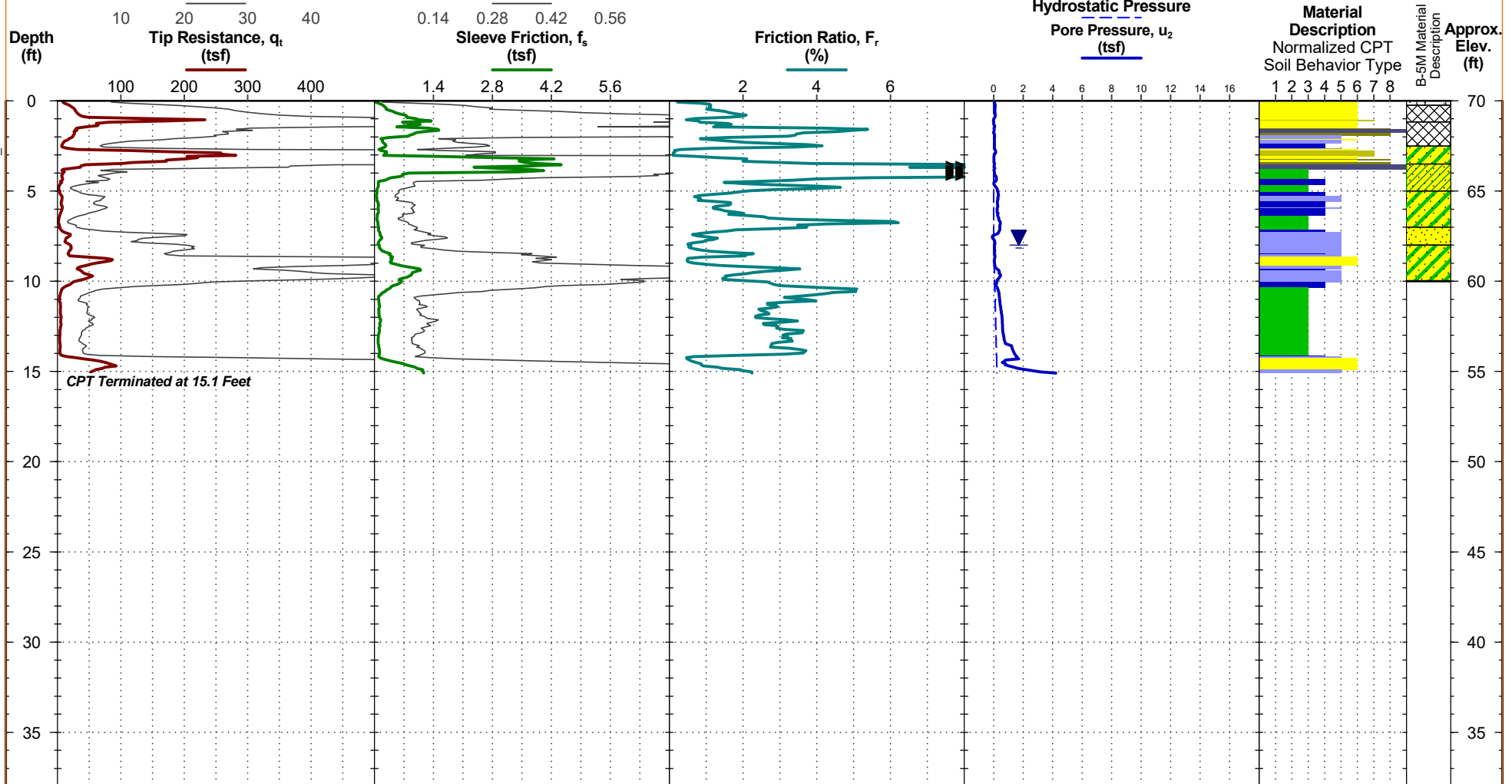
PROJECT: Farmville Fire Station

CLIENT: Davis Kane Architects PA
Raleigh, NC

TEST LOCATION: See [Exploration Plan](#)

Approx. Surface Elev: 70 ft +/- Adjacent Test: B-5M
Latitude: 35.6038059151445°
Longitude: -77.5903242054491°

SITE: 6101 May Blvd.
Farmville, NC



Cave in depth= 10.1 feet

Topsoil = 2 inches

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

See B-5M for the adjacent test's full details.

Auger anchors used as reaction force.

CPT sensor calibration reports available upon request.

- 1 Sensitive, fine grained
- 2 Organic soils - clay
- 3 Clay - silty clay to clay
- 4 Silt mixtures - clayey silt to silty clay
- 5 Sand mixtures - silty sand to sandy silt
- 6 Sands - clean sand to silty sand
- 7 Gravelly sand to dense sand
- 8 Very stiff sand to clayey sand
- 9 Very stiff fine grained

WATER LEVEL OBSERVATION

8 ft measured water depth
(used in normalizations and correlations;
See [Supporting Information](#))

Probe no. 5143 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 2/1/2019
Tip and sleeve areas of 10 cm² and 150 cm²
Ring friction reducer with O.D. of 1.875 in

Terracon
314 Beacon Dr
Winterville, NC

CPT Started: 10/26/2021

Rig: Geoprobe

Project No.: 72205105

CPT Completed: 10/26/2021

Operator: RDU

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. CPT REPORT 72205105 FARMVILLE FIRE ST.GPJ TERRACON_DATATEMPLATE.GDT 11/24/21

BORING LOG NO. B-5M

Page 1 of 1

PROJECT: Farmville Fire Station

CLIENT: Davis Kane Architects PA
Raleigh, NC

SITE: 6101 May Blvd.
Farmville, NC

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.6038° Longitude: -77.5903° Approximate Surface Elev.: 70 (Ft.) +/- ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		DEPTH						
		0.3 TOPSOIL , - 3 inches	70+/-					
		FILL - CLAYEY SAND						
1		1.2	69+/-	1				
		FILL - SILTY SAND WITH GRAVEL						
		2.5	67.5+/-	2				
		CLAYEY SAND (SC) , dark brown						
		3.5	66.5+/-	3				
		SANDY LEAN CLAY (CL) , brown						
		5.0	65+/-	4				
		CLAYEY SAND (SC) , dark gray						
2		7.0	63+/-	5				
		POORLY GRADED SAND (SP) , gray						
		8.0	62+/-	6				
		CLAYEY SAND (SC) , dark gray						
		10.0	60+/-	7				
		Boring Terminated at 10 Feet						

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Direct Push

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).


Notes:

Abandonment Method:

See [Supporting Information](#) for explanation of symbols and abbreviations.

WATER LEVEL OBSERVATIONS

See CPT log

 Cave in

Terracon

314 Beacon Dr
Winterville, NC

Boring Started: 10-26-2021

Boring Completed: 10-26-2021

Drill Rig: Geoprobe

Driller: RDU

Project No.: 72205105

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 72205105 FARMVILLE FIRE ST.GPJ TERRACON_DATATEMPLATE.GDT 11/24/21

CPT LOG NO. B-6

Page 1 of 1

PROJECT: Farmville Fire Station

CLIENT: Davis Kane Architects PA
Raleigh, NC

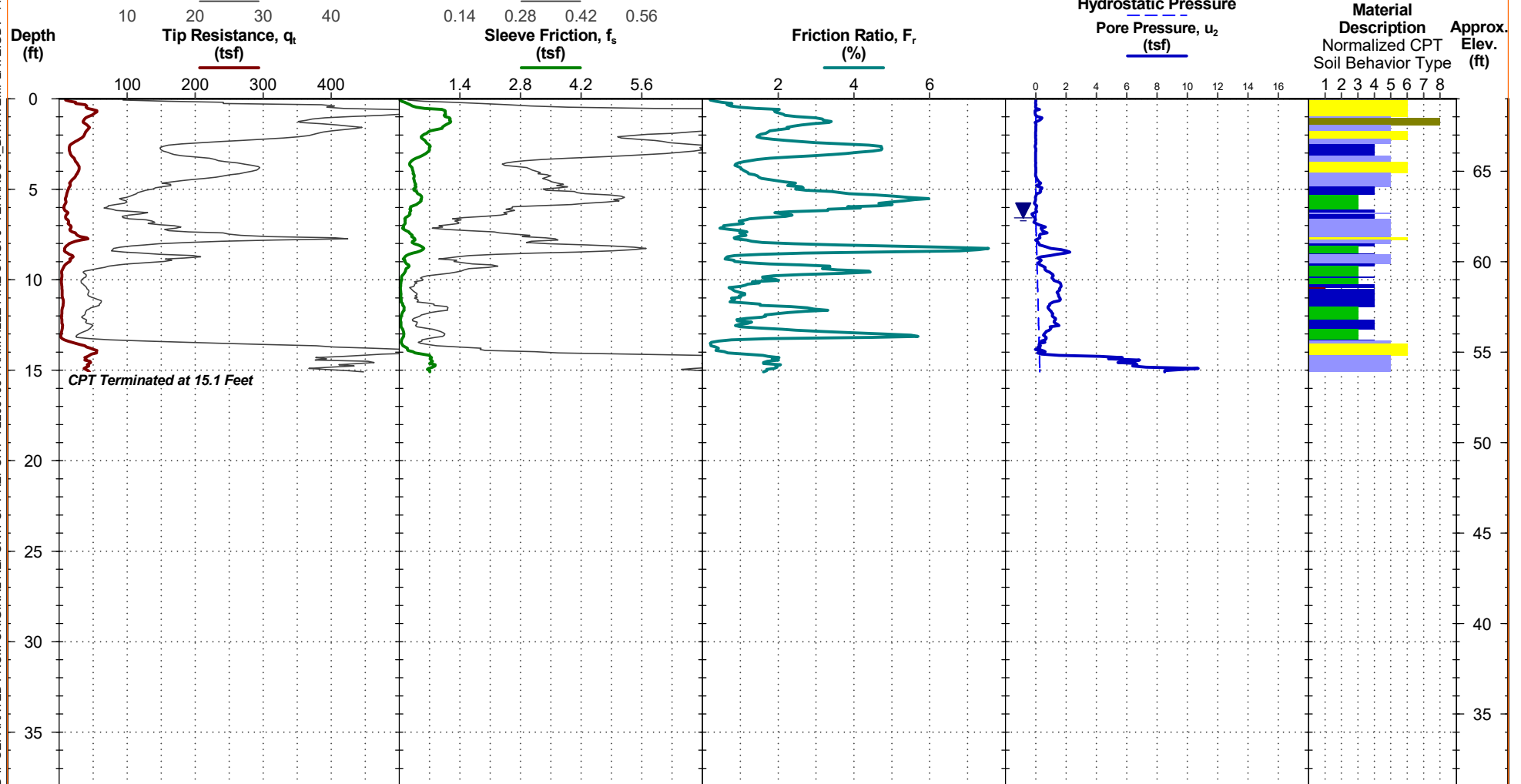
TEST LOCATION: See [Exploration Plan](#)

SITE: 6101 May Blvd.
Farmville, NC

Approx. Surface Elev: 69 ft +/-

Latitude: 35.6038443081407°

Longitude: -77.5901999918927°



Cave in depth= 6.6 feet

Topsoil = 2 inches

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

Auger anchors used as reaction force.

CPT sensor calibration reports available upon request.

- 1 Sensitive, fine grained
- 2 Organic soils - clay
- 3 Clay - silty clay to clay
- 4 Silt mixtures - clayey silt to silty clay
- 5 Sand mixtures - silty sand to sandy silt
- 6 Sands - clean sand to silty sand
- 7 Gravelly sand to dense sand
- 8 Very stiff sand to clayey sand
- 9 Very stiff fine grained

WATER LEVEL OBSERVATION

6.583 ft estimated water depth
(used in normalizations and correlations;
See [Supporting Information](#))

Probe no. 5143 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 2/1/2019
Tip and sleeve areas of 10 cm² and 150 cm²
Ring friction reducer with O.D. of 1.875 in

Terracon
314 Beacon Dr
Winterville, NC

CPT Started: 10/26/2021

Rig: Geoprobe

Project No.: 72205105

CPT Completed: 10/26/2021

Operator: RDU

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. CPT REPORT 72205105 FARMVILLE FIRE ST.GPJ TERRACON_DATATEMPLATE.GDT 11/24/21

CPT LOG NO. B-7

Page 1 of 1

PROJECT: Farmville Fire Station

CLIENT: Davis Kane Architects PA
Raleigh, NC

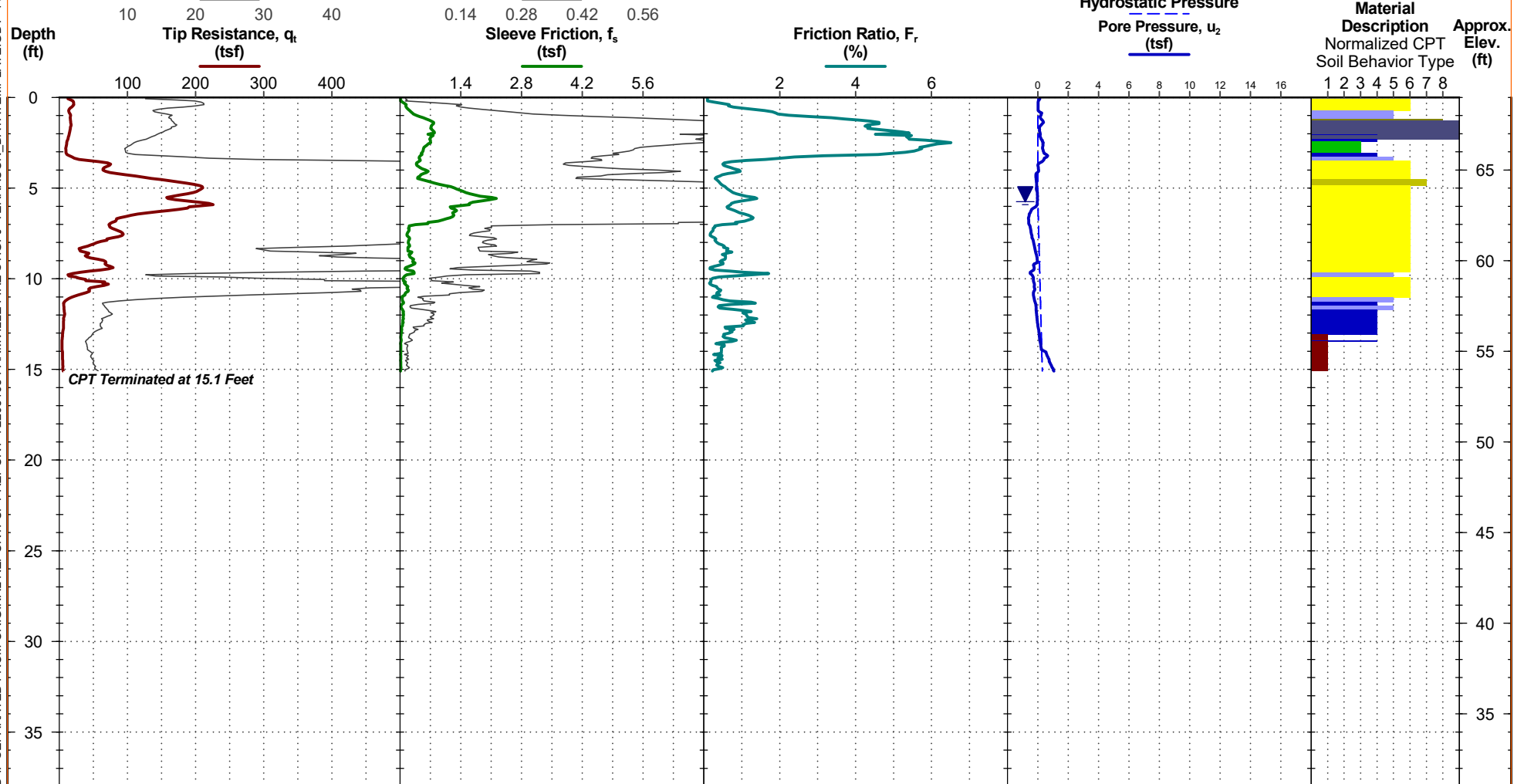
TEST LOCATION: See [Exploration Plan](#)

SITE: 6101 May Blvd.
Farmville, NC

Approx. Surface Elev: 69 ft +/-

Latitude: 35.6038238402634°

Longitude: -77.5900224389602°



Cave in depth= 8.7 feet

Topsoil = 2 inches

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

Auger anchors used as reaction force.

CPT sensor calibration reports available upon request.

- 1 Sensitive, fine grained
- 2 Organic soils - clay
- 3 Clay - silty clay to clay
- 4 Silt mixtures - clayey silt to silty clay
- 5 Sand mixtures - silty sand to sandy silt
- 6 Sands - clean sand to silty sand
- 7 Gravelly sand to dense sand
- 8 Very stiff sand to clayey sand
- 9 Very stiff fine grained

WATER LEVEL OBSERVATION

5.75 ft measured water depth
(used in normalizations and correlations;
See [Supporting Information](#))

Probe no. 5143 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 2/1/2019
Tip and sleeve areas of 10 cm² and 150 cm²
Ring friction reducer with O.D. of 1.875 in

Terracon
314 Beacon Dr
Winterville, NC

CPT Started: 10/26/2021

Rig: Geoprobe

Project No.: 72205105

CPT Completed: 10/26/2021

Operator: RDU

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. CPT REPORT 72205105 FARMVILLE FIRE ST.GPJ TERRACON_DATATEMPLATE.GDT 11/24/21

CPT LOG NO. B-9

Page 1 of 1

PROJECT: Farmville Fire Station

CLIENT: Davis Kane Architects PA
Raleigh, NC

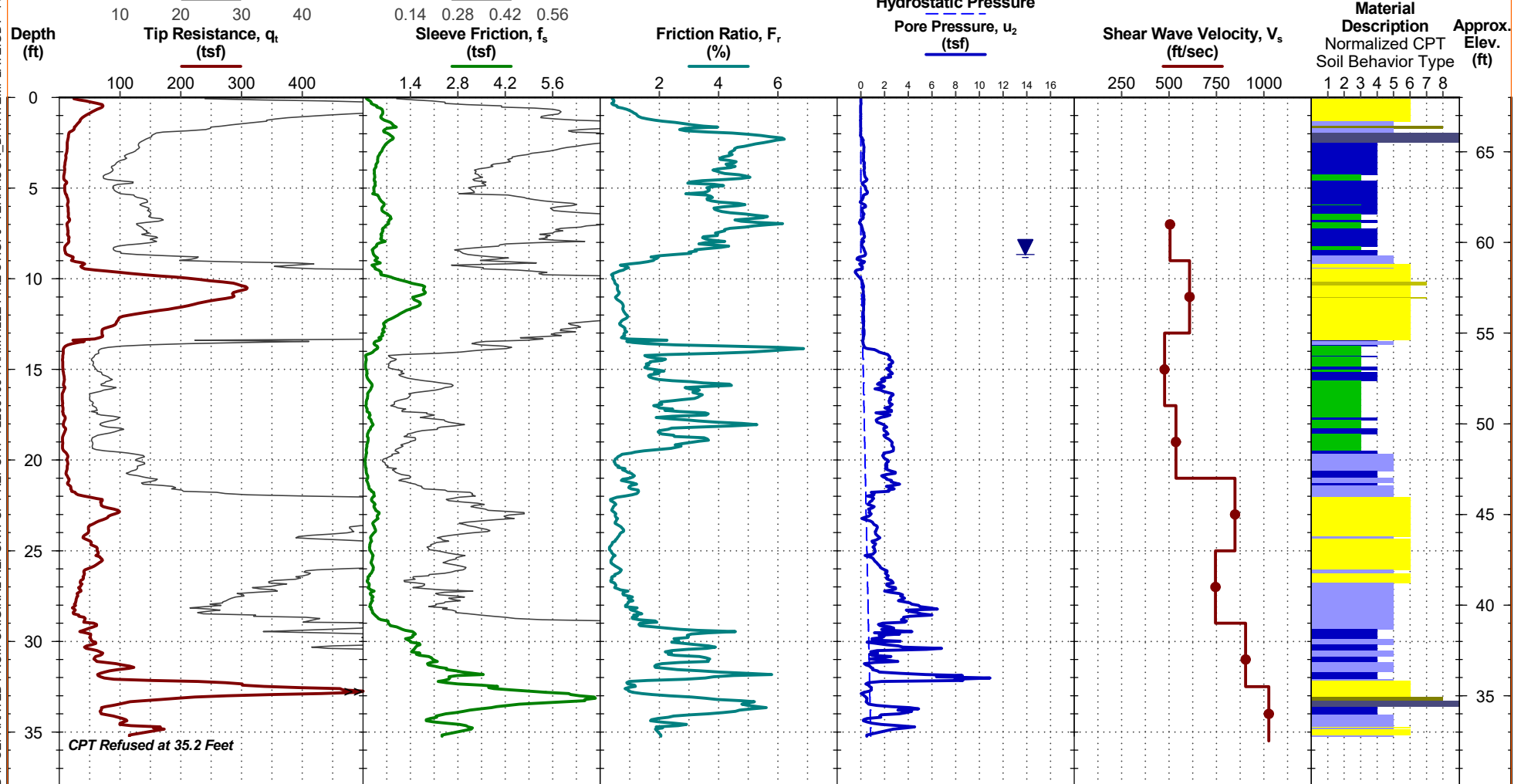
TEST LOCATION: See [Exploration Plan](#)

SITE: 6101 May Blvd.
Farmville, NC

Approx. Surface Elev: 68 ft +/-

Latitude: 35.6039377639665°

Longitude: -77.5899169587451°



Cave in depth= 13.0 feet

Topsoil = 2 inches

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

Auger anchors used as reaction force.

CPT sensor calibration reports available upon request.

- 1 Sensitive, fine grained
- 2 Organic soils - clay
- 3 Clay - silty clay to clay
- 4 Silt mixtures - clayey silt to silty clay
- 5 Sand mixtures - silty sand to sandy silt
- 6 Sands - clean sand to silty sand
- 7 Gravelly sand to dense sand
- 8 Very stiff sand to clayey sand
- 9 Very stiff fine grained

WATER LEVEL OBSERVATION

8.667 ft measured water depth
(used in normalizations and correlations;
See [Supporting Information](#))

Probe no. 5143 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 2/1/2019
Tip and sleeve areas of 10 cm² and 150 cm²
Ring friction reducer with O.D. of 1.875 in

Terracon
314 Beacon Dr
Winterville, NC

CPT Started: 10/26/2021

Rig: Geoprobe

Project No.: 72205105

CPT Completed: 10/26/2021

Operator: RDU

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. CPT REPORT 72205105 FARMVILLE FIRE ST.GPJ TERRACON_DATATEMPLATE.GDT 11/24/21

CPT LOG NO. B-10

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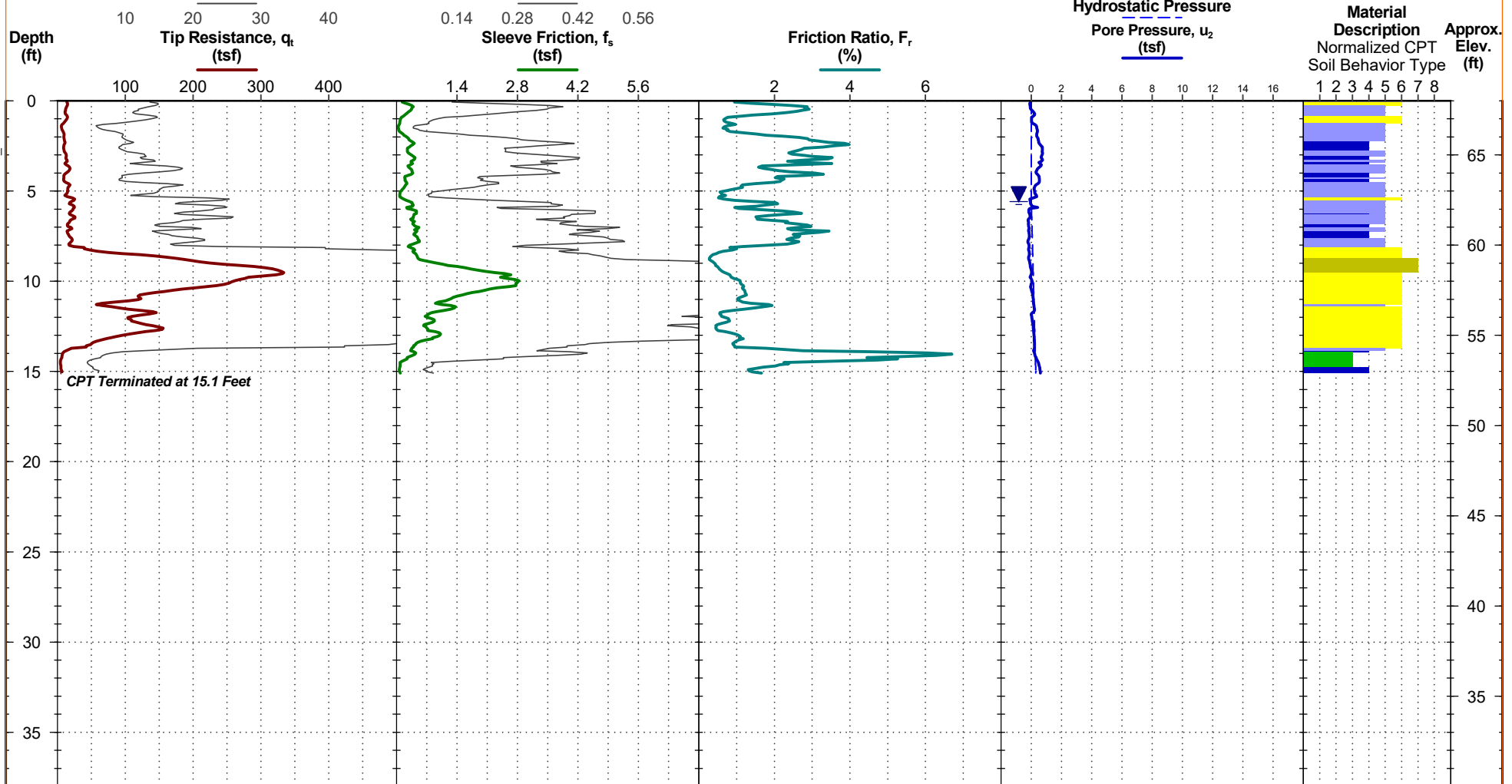
PROJECT: Farmville Fire Station

CLIENT: Davis Kane Architects PA
Raleigh, NC

TEST LOCATION: See [Exploration Plan](#)

SITE: 6101 May Blvd.
Farmville, NC

Approx. Surface Elev: 68 ft +/-
Latitude: 35.6040830202236°
Longitude: -77.5899467337562°



Cave in depth= 5.6 feet

Topsoil = 2 inches

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

Auger anchors used as reaction force.

CPT sensor calibration reports available upon request.

- 1 Sensitive, fine grained
- 2 Organic soils - clay
- 3 Clay - silty clay to clay
- 4 Silt mixtures - clayey silt to silty clay
- 5 Sand mixtures - silty sand to sandy silt
- 6 Sands - clean sand to silty sand
- 7 Gravelly sand to dense sand
- 8 Very stiff sand to clayey sand
- 9 Very stiff fine grained

WATER LEVEL OBSERVATION

5.583 ft estimated water depth
(used in normalizations and correlations;
See [Supporting Information](#))

Probe no. 5143 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 2/1/2019
Tip and sleeve areas of 10 cm² and 150 cm²
Ring friction reducer with O.D. of 1.875 in

Terracon
314 Beacon Dr
Winterville, NC

CPT Started: 10/26/2021

Rig: Geoprobe

Project No.: 72205105

CPT Completed: 10/26/2021

Operator: RDU

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. CPT REPORT 72205105 FARMVILLE FIRE ST.GPJ TERRACON_DATATEMPLATE.GDT 11/24/21

CPT LOG NO. B-11

Page 1 of 1

PROJECT: Farmville Fire Station

CLIENT: Davis Kane Architects PA
Raleigh, NC

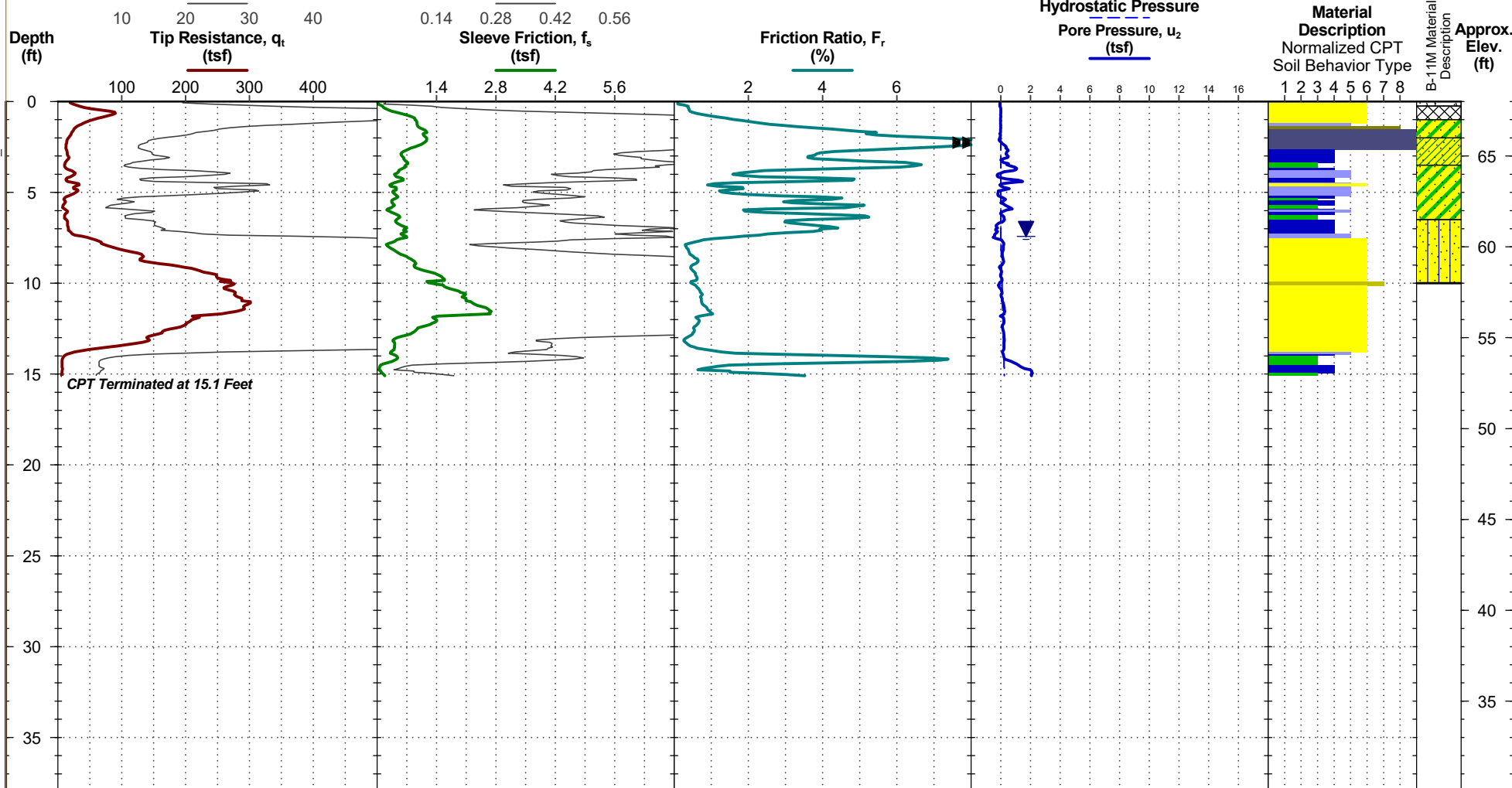
TEST LOCATION: See [Exploration Plan](#)

Approx. Surface Elev: 68 ft +/- Adjacent Test: B-11M

Latitude: 35.6039486697562°

Longitude: -77.5897340784972°

SITE: 6101 May Blvd.
Farmville, NC



Cave in depth= 8.8 feet

Topsoil = 2 inches

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

See B-11M for the adjacent test's full details.

Auger anchors used as reaction force.

CPT sensor calibration reports available upon request.

- 1 Sensitive, fine grained
- 2 Organic soils - clay
- 3 Clay - silty clay to clay
- 4 Silt mixtures - clayey silt to silty clay
- 5 Sand mixtures - silty sand to sandy silt
- 6 Sands - clean sand to silty sand
- 7 Gravelly sand to dense sand
- 8 Very stiff sand to clayey sand
- 9 Very stiff fine grained

WATER LEVEL OBSERVATION

7.4167 ft measured water depth
(used in normalizations and correlations;
See [Supporting Information](#))

Probe no. 5143 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 2/1/2019
Tip and sleeve areas of 10 cm² and 150 cm²
Ring friction reducer with O.D. of 1.875 in

Terracon
314 Beacon Dr
Winterville, NC

CPT Started: 10/26/2021

Rig: Geoprobe

Project No.: 72205105

CPT Completed: 10/26/2021

Operator: RDU

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. CPT REPORT 72205105 FARMVILLE FIRE ST.GPJ TERRACON_DATATEMPLATE.GDT 11/24/21

BORING LOG NO. B-11M

Page 1 of 1

PROJECT: Farmville Fire Station

CLIENT: Davis Kane Architects PA
Raleigh, NC

SITE: 6101 May Blvd.
Farmville, NC

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.6039° Longitude: -77.5897° Approximate Surface Elev.: 68 (Ft.) +/- ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		DEPTH						
		0.3 TOPSOIL , - 3 inches	68+/-					
1		FILL - SILTY SAND , brown						
		1.0	67+/-	1		18.2		
		CLAYEY SAND (SC) , trace organics, brown with black/orange						
		2.0	66+/-	2				
		SANDY LEAN CLAY (CL) , brown with orange						
		3.5	64.5+/-	3				
		CLAYEY SAND (SC) , brown with orange to brownish gray						
		6.5	61.5+/-	6		19.6	29-14-15	41
		SILTY SAND (SM) , brownish gray						
		10.0	58+/-	10		21.2		
		Boring Terminated at 10 Feet						

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Direct Push

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).


Notes:

Abandonment Method:

See [Supporting Information](#) for explanation of symbols and abbreviations.

WATER LEVEL OBSERVATIONS

See CPT log

 Cave in

Terracon

314 Beacon Dr
Winterville, NC

Boring Started: 10-26-2021

Boring Completed: 10-26-2021

Drill Rig: Geoprobe

Driller: RDU

Project No.: 72205105

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 72205105 FARMVILLE FIRE ST.GPJ TERRACON_DATATEMPLATE.GDT 11/24/21

CPT LOG NO. B-12

Page 1 of 1

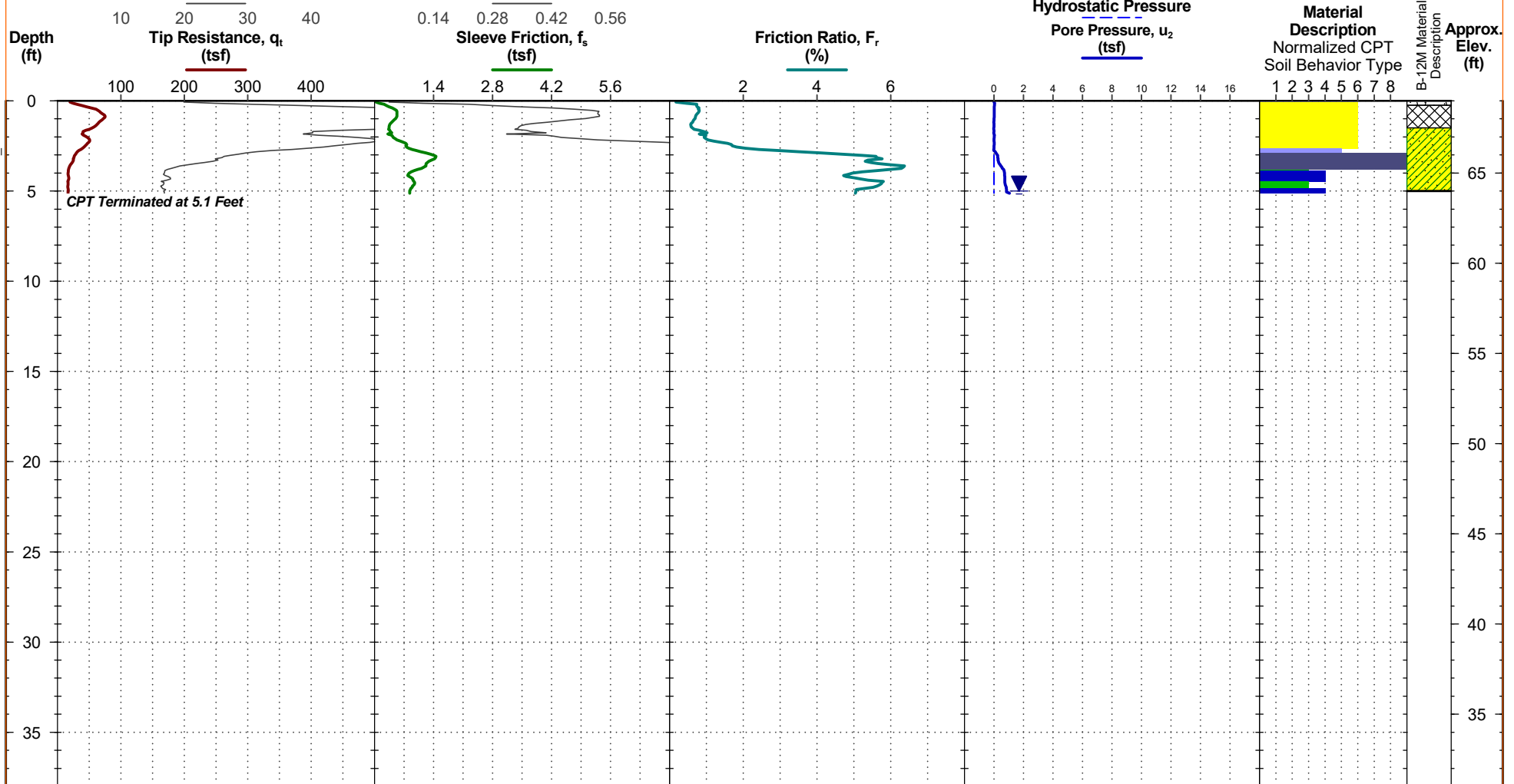
PROJECT: Farmville Fire Station

CLIENT: Davis Kane Architects PA
Raleigh, NC

TEST LOCATION: See [Exploration Plan](#)

SITE: 6101 May Blvd.
Farmville, NC

Approx. Surface Elev: 69 ft +/- Adjacent Test: B-12M
Latitude: 35.6040983724212°
Longitude: -77.5902640918755°



Cave in depth= 5.0 feet

Topsoil = 2 inches

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

See B-12M for the adjacent test's full details.

Dead weight of rig used as reaction force.

CPT sensor calibration reports available upon request.

- 1 Sensitive, fine grained
- 2 Organic soils - clay
- 3 Clay - silty clay to clay
- 4 Silt mixtures - clayey silt to silty clay
- 5 Sand mixtures - silty sand to sandy silt
- 6 Sands - clean sand to silty sand
- 7 Gravelly sand to dense sand
- 8 Very stiff sand to clayey sand
- 9 Very stiff fine grained

WATER LEVEL OBSERVATION

5 ft estimated water depth
(used in normalizations and correlations;
See [Supporting Information](#))

Probe no. 5143 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 2/1/2019
Tip and sleeve areas of 10 cm² and 150 cm²
Ring friction reducer with O.D. of 1.875 in

Terracon
314 Beacon Dr
Winterville, NC

CPT Started: 10/26/2021

Rig: Geoprobe

Project No.: 72205105

CPT Completed: 10/26/2021

Operator: RDU

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. CPT REPORT 72205105 FARMVILLE FIRE ST.GPJ TERRACON_DATATEMPLATE.GDT 11/24/21



BORING LOG NO. B-12M

Page 1 of 1

PROJECT: Farmville Fire Station

CLIENT: Davis Kane Architects PA
Raleigh, NC

SITE: 6101 May Blvd.
Farmville, NC

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.6041° Longitude: -77.5903° Approximate Surface Elev.: 69 (Ft.) +/- ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		DEPTH						
		0.3 TOPSOIL , - 3 inches	69+/-					
1		FILL - SILTY SAND , brown						
		1.5	67.5+/-					
2		SANDY LEAN CLAY (CL) , brownish gray with orange						
		5.0	64+/-					
		Boring Terminated at 5 Feet						

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Direct Push

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

Notes:

Abandonment Method:

See [Supporting Information](#) for explanation of symbols and abbreviations.

WATER LEVEL OBSERVATIONS

See *CPT log*


Boring Started: 10-26-2021

Boring Completed: 10-26-2021

Drill Rig: Geoprobe

Driller: RDU

Project No.: 72205105

 **Cave in**

Terracon

314 Beacon Dr
Winterville, NC

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 72205105 FARMVILLE FIRE ST.GPJ TERRACON_DATATEMPLATE.GDT 11/24/21

CPT LOG NO. B-13

Page 1 of 1

PROJECT: Farmville Fire Station

CLIENT: Davis Kane Architects PA
Raleigh, NC

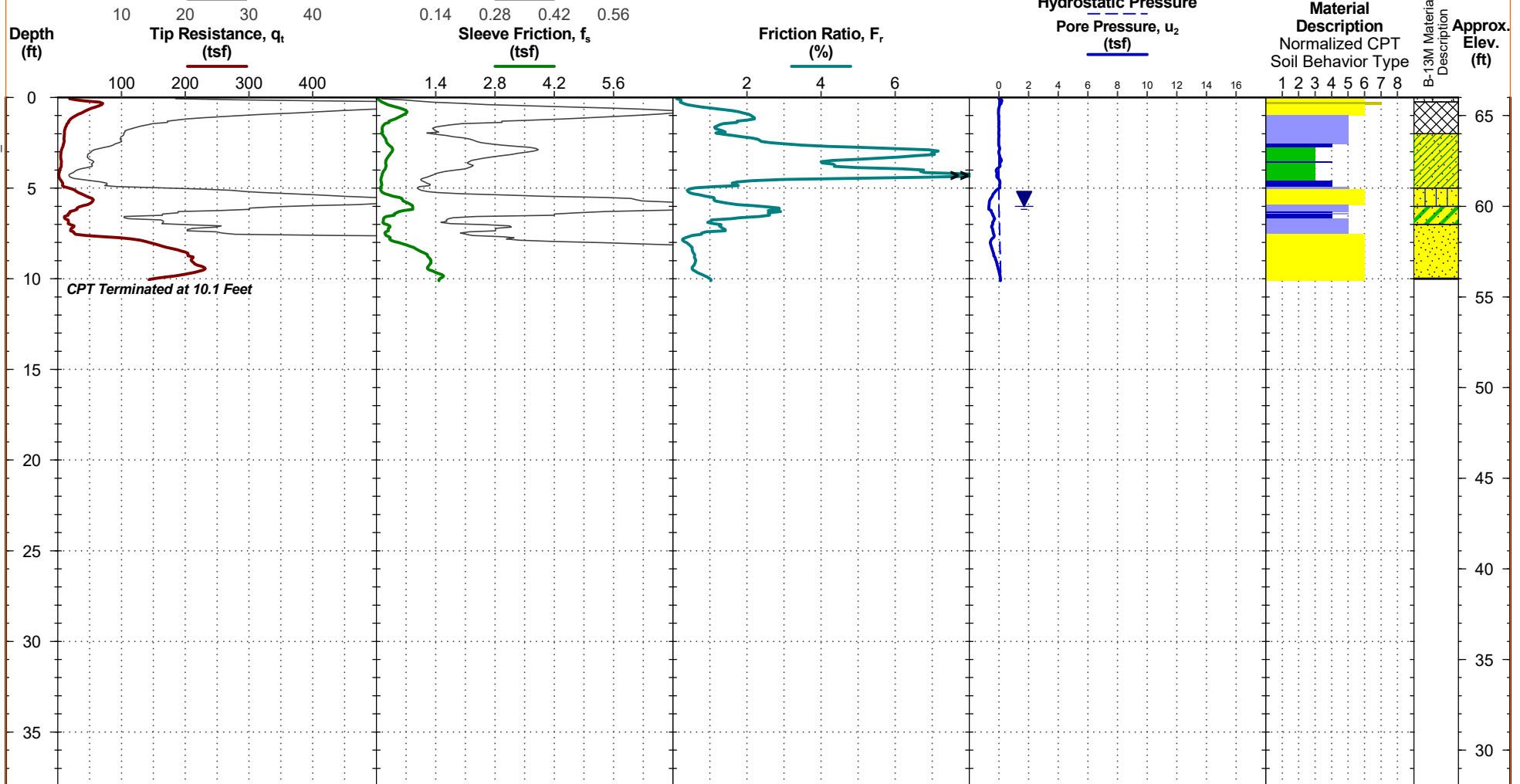
TEST LOCATION: See [Exploration Plan](#)

Approx. Surface Elev: 66 ft +/- Adjacent Test: B-13M

Latitude: 35.6043739113085°

Longitude: -77.5896719326032°

SITE: 6101 May Blvd.
Farmville, NC



Cave in depth= 13.0 feet

Topsoil = 2 inches

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

See B-13M for the adjacent test's full details.

Auger anchors used as reaction force.

CPT sensor calibration reports available upon request.

- 1 Sensitive, fine grained
- 2 Organic soils - clay
- 3 Clay - silty clay to clay
- 4 Silt mixtures - clayey silt to silty clay
- 5 Sand mixtures - silty sand to sandy silt
- 6 Sands - clean sand to silty sand
- 7 Gravelly sand to dense sand
- 8 Very stiff sand to clayey sand
- 9 Very stiff fine grained

WATER LEVEL OBSERVATION

6 ft measured water depth
(used in normalizations and correlations;
See [Supporting Information](#))

Probe no. 5143 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 2/1/2019
Tip and sleeve areas of 10 cm² and 150 cm²
Ring friction reducer with O.D. of 1.875 in

Terracon
314 Beacon Dr
Winterville, NC

CPT Started: 10/26/2021

Rig: Geoprobe

Project No.: 72205105

CPT Completed: 10/26/2021

Operator: RDU

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. CPT REPORT 72205105 FARMVILLE FIRE ST.GPJ TERRACON_DATATEMPLATE.GDT 11/24/21

BORING LOG NO. B-13M

Page 1 of 1

PROJECT: Farmville Fire Station

CLIENT: Davis Kane Architects PA
Raleigh, NC

SITE: 6101 May Blvd.
Farmville, NC

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 35.6044° Longitude: -77.5897° Approximate Surface Elev.: 66 (Ft.) +/- ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		DEPTH						
		0.3 TOPSOIL , -3 inches	66+/-					
1		FILL - SILTY SAND , brownish gray						
		2.0	64+/-					
		SANDY LEAN CLAY (CL) , brownish gray to gray						
			3					
			4					
		5.0	61+/-					
		SILTY SAND (SM) , gray						
2			6					
		6.0	60+/-					
		CLAYEY SAND (SC) , light brown						
			7					
		7.0	59+/-					
		POORLY GRADED SAND (SP) , light brown						
			8					
			9					
		10.0	56+/-					
		Boring Terminated at 10 Feet	10					

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Direct Push

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

Notes:

Abandonment Method:

See [Supporting Information](#) for explanation of symbols and abbreviations.

WATER LEVEL OBSERVATIONS

See CPT log

Cave in

Terracon

314 Beacon Dr
Winterville, NC

Boring Started: 10-26-2021

Boring Completed: 10-26-2021

Drill Rig: Geoprobe

Driller: RDU

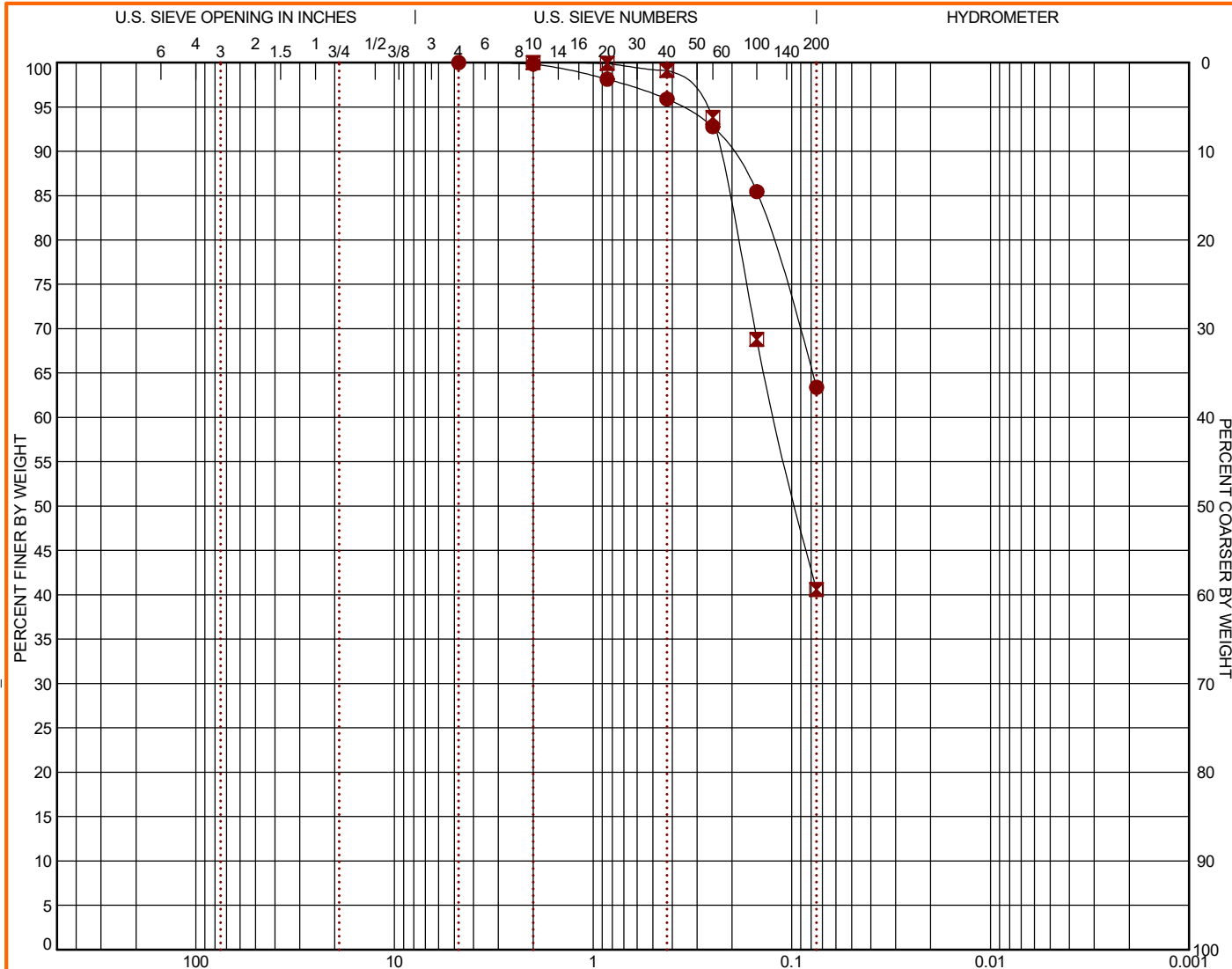
Project No.: 72205105

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GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 72205105 FARMVILLE FIRE ST.GPJ TERRACON_DATATEMPLATE.GDT 11/24/21



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
B-1M	2.5	0.0	0.0	36.6		63.4		CL
B-11M	6	0.0	0.0	59.4		40.6		SC

GRAIN SIZE				SOIL DESCRIPTION			
D ₆₀	0.121			#4	100.0	#10	100.0
D ₃₀				#10	99.82	#20	99.89
D ₁₀				#20	98.13	#40	99.12
				#40	95.89	#60	93.81
				#60	92.77	#100	68.81
				#100	85.45	#200	40.6
				#200	63.39		
COEFFICIENTS				REMARKS			
C _c							
C _u							

- SANDY LEAN CLAY (CL)
- ✕ CLAYEY SAND (SC)

- 2.5-3 ft
- ✕ 5.5-6 ft

PROJECT: Farmville Fire Station

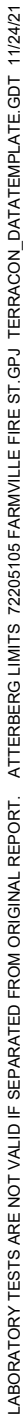
SITE: 6101 May Blvd.
Farmville, NC

Terracon
314 Beacon Dr
Winterville, NC

PROJECT NUMBER: 72205105

CLIENT: Davis Kane Architects PA
Raleigh, NC

ASTM D4318



CLIENT: Davis Kane Architects PA
Raleigh, NC

SUPPORTING INFORMATION

Contents:

General Notes





Unified Soil Classification System

CPT General Notes

Note: All attachments are one page unless noted above.

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING	WATER LEVEL	FIELD TESTS
 GeoProbe Macro Core or Large Bore	 Water Initially Encountered  Water Level After a Specified Period of Time  Water Level After a Specified Period of Time <p>Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.</p>	N Standard Penetration Test Resistance (Blows/Ft.) (HP) Hand Penetrometer (T) Torvane (DCP) Dynamic Cone Penetrometer UC Unconfined Compressive Strength (PID) Photo-Ionization Detector (OVA) Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION
<p>Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.</p>
LOCATION AND ELEVATION NOTES
<p>Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.</p>

STRENGTH TERMS				
RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Descriptive Term (Density)	Standard Penetration or N-Value Blows/Ft.	Descriptive Term (Consistency)	Unconfined Compressive Strength Qu, (tsf)	Standard Penetration or N-Value Blows/Ft.
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	4 - 8
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	> 4.00	> 30

RELATIVE PROPORTIONS OF SAND AND GRAVEL		RELATIVE PROPORTIONS OF FINES	
Descriptive Term(s) of other constituents	Percent of Dry Weight	Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	<15	Trace	<5
With	15-29	With	5-12
Modifier	>30	Modifier	>12
GRAIN SIZE TERMINOLOGY		PLASTICITY DESCRIPTION	
Major Component of Sample	Particle Size	Term	Plasticity Index
Boulders	Over 12 in. (300 mm)	Non-plastic	0
Cobbles	12 in. to 3 in. (300mm to 75mm)	Low	1 - 10
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)	Medium	11 - 30
Sand	#4 to #200 sieve (4.75mm to 0.075mm)	High	> 30
Silt or Clay	Passing #200 sieve (0.075mm)		

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A					Soil Classification	
					Group Symbol	Group Name ^B
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	Gravels: More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels: Less than 5% fines ^C	Cu ³ 4 and 1 £ Cc £ 3 ^E	GW	Well-graded gravel ^F	
			Cu < 4 and/or [Cc<1 or Cc>3.0] ^E	GP	Poorly graded gravel ^F	
		Gravels with Fines: More than 12% fines ^C	Fines classify as ML or MH	GM	Silty gravel ^{F, G, H}	
			Fines classify as CL or CH	GC	Clayey gravel ^{F, G, H}	
	Sands: 50% or more of coarse fraction passes No. 4 sieve	Clean Sands: Less than 5% fines ^D	Cu ³ 6 and 1 £ Cc £ 3 ^E	SW	Well-graded sand ^I	
			Cu < 6 and/or [Cc<1 or Cc>3.0] ^E	SP	Poorly graded sand ^I	
		Sands with Fines: More than 12% fines ^D	Fines classify as ML or MH	SM	Silty sand ^{G, H, I}	
			Fines classify as CL or CH	SC	Clayey sand ^{G, H, I}	
Fine-Grained Soils: 50% or more passes the No. 200 sieve	Silts and Clays: Liquid limit less than 50	Inorganic:	PI > 7 and plots on or above “A”	CL	Lean clay ^{K, L, M}	
			PI < 4 or plots below “A” line ^J	ML	Silt ^{K, L, M}	
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay ^{K, L, M, N}
			Liquid limit - not dried		Organic silt ^{K, L, M, O}	
	Silts and Clays: Liquid limit 50 or more	Inorganic:	PI plots on or above “A” line	CH	Fat clay ^{K, L, M}	
			PI plots below “A” line	MH	Elastic Silt ^{K, L, M}	
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay ^{K, L, M, P}
			Liquid limit - not dried		Organic silt ^{K, L, M, Q}	
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat	

^A Based on the material passing the 3-inch (75-mm) sieve.

^B If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

^C Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

^D Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

$$^E Cu = D_{60}/D_{10} \quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

^F If soil contains ³ 15% sand, add "with sand" to group name.

^G If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

^H If fines are organic, add "with organic fines" to group name.

^I If soil contains ³ 15% gravel, add "with gravel" to group name.

^J If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

^K If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

^L If soil contains ³ 30% plus No. 200 predominantly sand, add "sandy" to group name.

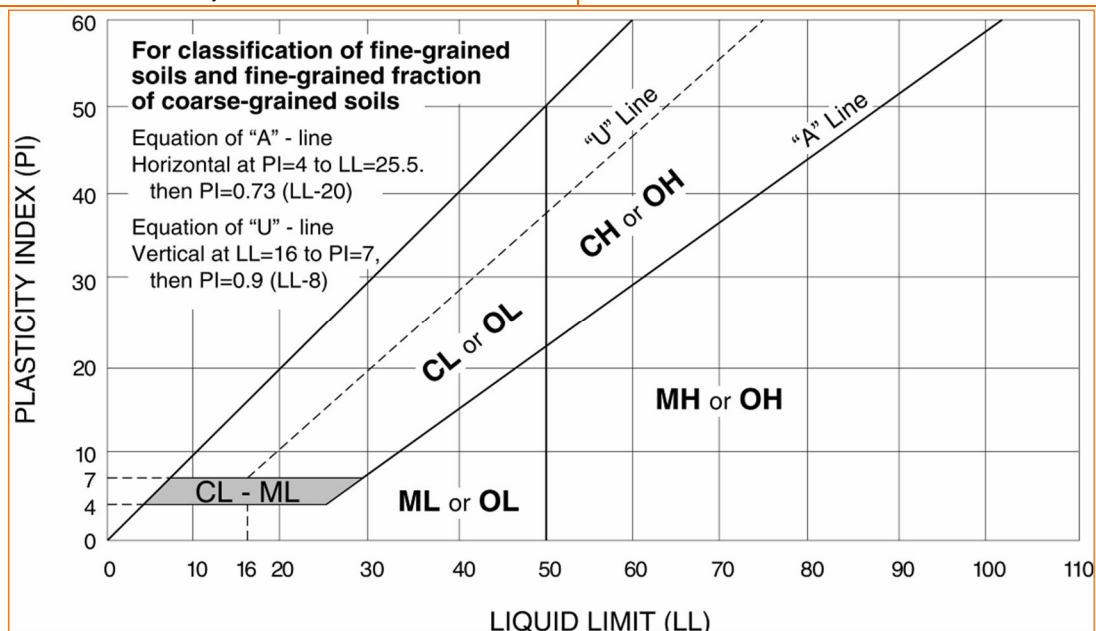
^M If soil contains ³ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

^N PI ³ 4 and plots on or above "A" line.

^O PI < 4 or plots below "A" line.

^P PI plots on or above "A" line.

^Q PI plots below "A" line.



CPT GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

DESCRIPTION OF GEOTECHNICAL CORRELATION

DESCRIPTION OF MEASUREMENTS AND CALIBRATIONS

To be reported per ASTM D5778:

Uncorrected Tip Resistance, q_c
Measured force acting on the cone divided by the cone's projected area

Corrected Tip Resistance, q_t
Cone resistance corrected for porewater and net area ratio effects
 $q_t = q_c + u_2(1 - a)$

Where a is the net area ratio, a lab calibration of the cone typically between 0.70 and 0.85

Pore Pressure, u
Pore pressure measured during penetration
 u_1 - sensor on the face of the cone
 u_2 - sensor on the shoulder (more common)

Sleeve Friction, f_s
Frictional force acting on the sleeve divided by its surface area

Normalized Friction Ratio, F_r
The ratio as a percentage of f_s to q_t , accounting for overburden pressure

To be reported per ASTM D7400, if collected:

Shear Wave Velocity, V_s
Measured in a Seismic CPT and provides direct measure of soil stiffness

Normalized Tip Resistance, Q_{tn}

$$Q_{tn} = ((q_t - \sigma_{v0})/P_a)(P_a/\sigma'_{v0})^n$$
$$n = 0.381(I_c) + 0.05(\sigma'_{v0}/P_a) - 0.15$$

Over Consolidation Ratio, OCR

$$OCR(1) = 0.25(Q_{tn})^{0.25}$$

$$OCR(2) = 0.33(Q_{tn})$$

Undrained Shear Strength, S_u

$$S_u = Q_{tn} \times \sigma'_{v0}/N_{kt}$$

N_{kt} is a soil-specific factor (shown on S_u plot)

Sensitivity, S_t

$$S_t = (q_t - \sigma'_{v0}/N_{kt}) \times (1/f_s)$$

Effective Friction Angle, ϕ'

$$\phi'(1) = \tan^{-1}(0.373[\log(q_t/\sigma'_{v0}) + 0.29])$$

$$\phi'(2) = 17.6 + 11[\log(Q_{tn})]$$

Unit Weight, γ

$$\gamma = (0.27[\log(F_r)] + 0.36[\log(q_t/\text{atm})] + 1.236) \times \gamma_{\text{water}}$$

σ_{v0} is taken as the incremental sum of the unit weights

Small Strain Shear Modulus, G_0

$$G_0(1) = \rho V_s^2$$

$$G_0(2) = 0.015 \times 10^{(0.55I_c + 1.68)}(q_t - \sigma_{v0})$$

Soil Behavior Type Index, I_c

$$I_c = [(3.47 - \log(Q_{tn}))^2 + (\log(F_r) + 1.22)^2]^{0.5}$$

SPT N_{60}

$$N_{60} = (q_t/\text{atm}) / 10^{(1.1268 - 0.2817I_c)}$$

Elastic Modulus, E_s (assumes $q_t/\text{atm} \sim 0.3$, i.e. FS = 3)

$$E_s(1) = 2.6\psi G_0 \text{ where } \psi = 0.56 - 0.33\log Q_{tn, \text{clean sand}}$$

$$E_s(2) = G_0$$

$$E_s(3) = 0.015 \times 10^{(0.55I_c + 1.68)}(q_t - \sigma_{v0})$$

$$E_s(4) = 2.5q_t$$

Constrained Modulus, M

$$M = \alpha_M(q_t - \sigma_{v0})$$

For $I_c > 2.2$ (fine-grained soils)

$\alpha_M = Q_{tn}$ with maximum of 14

For $I_c < 2.2$ (coarse-grained soils)

$$\alpha_M = 0.0188 \times 10^{(0.55I_c + 1.68)}$$

Hydraulic Conductivity, k

$$\text{For } 1.0 < I_c < 3.27 \quad k = 10^{(0.952 - 3.04I_c)}$$

$$\text{For } 3.27 < I_c < 4.0 \quad k = 10^{(-4.52 - 1.37I_c)}$$

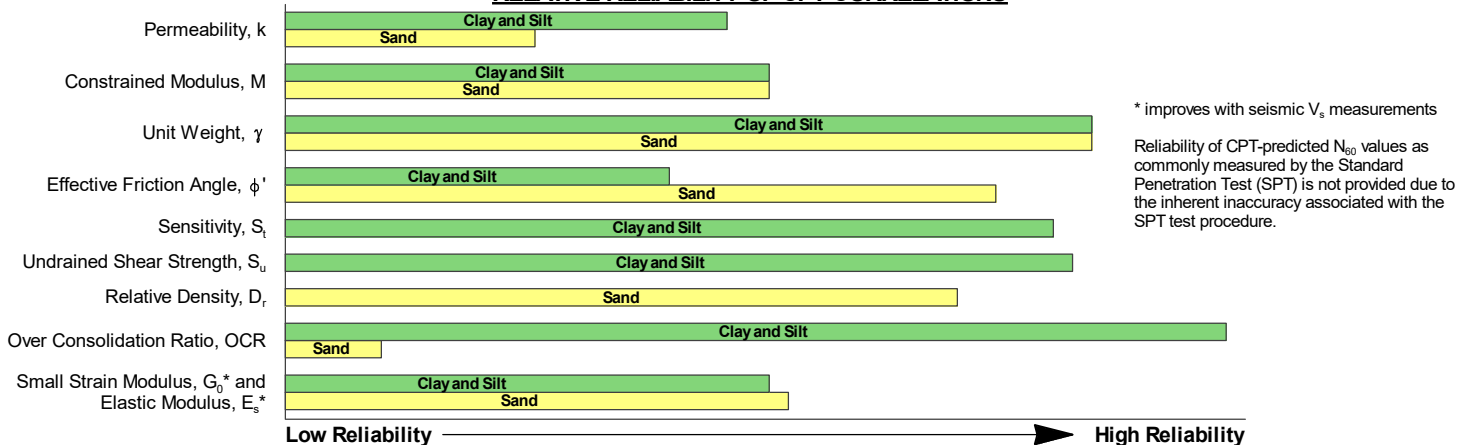
Relative Density, D_r

$$D_r = (Q_{tn} / 350)^{0.5} \times 100$$

REPORTED PARAMETERS

CPT logs as provided, at a minimum, report the data as required by ASTM D5778 and ASTM D7400 (if applicable). This minimum data include q_t , f_s , and u . Other correlated parameters may also be provided. These other correlated parameters are interpretations of the measured data based upon published and reliable references, but they do not necessarily represent the actual values that would be derived from direct testing to determine the various parameters. To this end, more than one correlation to a given parameter may be provided. The following chart illustrates estimates of reliability associated with correlated parameters based upon the literature referenced below.

RELATIVE RELIABILITY OF CPT CORRELATIONS



WATER LEVEL

The groundwater level at the CPT location is used to normalize the measurements for vertical overburden pressures and as a result influences the normalized soil behavior type classification and correlated soil parameters. The water level may either be "measured" or "estimated:"

Measured - Depth to water directly measured in the field

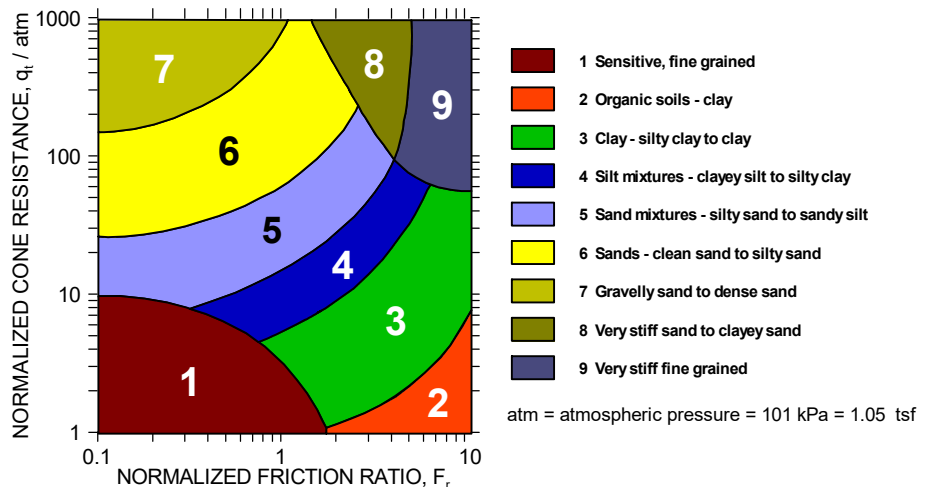
Estimated - Depth to water interpolated by the practitioner using pore pressure measurements in coarse grained soils and known site conditions

While groundwater levels displayed as "measured" more accurately represent site conditions at the time of testing than those "estimated," in either case the groundwater should be further defined prior to construction as groundwater level variations will occur over time.

CONE PENETRATION SOIL BEHAVIOR TYPE

The estimated stratigraphic profiles included in the CPT logs are based on relationships between corrected tip resistance (q_t), friction resistance (f_s), and porewater pressure (u_2). The normalized friction ratio (F_r) is used to classify the soil behavior type.

Typically, silts and clays have high F_r values and generate large excess penetration porewater pressures; sands have lower F_r 's and do not generate excess penetration porewater pressures. The adjacent graph (Robertson *et al.*) presents the soil behavior type correlation used for the logs. This normalized SBT chart, generally considered the most reliable, does not use pore pressure to determine SBT due to its lack of repeatability in onshore CPTs.



REFERENCES

- Kulhawy, F.H., Mayne, P.W., (1997). "Manual on Estimating Soil Properties for Foundation Design," Electric Power Research Institute, Palo Alto, CA.
- Mayne, P.W., (2013). "Geotechnical Site Exploration in the Year 2013," Georgia Institute of Technology, Atlanta, GA.
- Robertson, P.K., Cabal, K.L., (2012). "Guide to Cone Penetration Testing for Geotechnical Engineering," Signal Hill, CA.
- Schmertmann, J.H., (1970). "Static Cone to Compute Static Settlement over Sand," *Journal of the Soil Mechanics and Foundations Division*, 96(SM3), 1011-1043.

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FORM OF PROPOSAL

Farmville Fire Station & Headquarters

Contract: _____

Town of Farmville

Bidder: _____

Date: _____

The undersigned, as bidder, hereby declares that the only person or persons interested in this proposal as principal or principals is or are named herein and that no other person than herein mentioned has any interest in this proposal or in the contract to be entered into; that this proposal is made without connection with any other person, company or parties making a bid or proposal; and that it is in all respects fair and in good faith without collusion or fraud. The bidder further declares that he has examined the site of the work and the contract documents relative thereto, and has read all special provisions furnished prior to the opening of bids; that he has satisfied himself relative to the work to be performed. The bidder further declares that he and his subcontractors have fully complied with NCGS 64, Article 2 in regards to E-Verification as required by Section 2.(c) of Session Law 2013-418, codified as N.C. Gen. Stat. § 143-129(j).

The Bidder proposes and agrees if this proposal is accepted to contract with **The Town of Farmville** in the form of contract specified below, to furnish all necessary materials, equipment, machinery, tools, apparatus, means of transportation and labor necessary to complete the construction of Bear Creek Fire Station in full in complete accordance with the plans, specifications and contract documents, to the full and entire satisfaction of The Town of Farmville and Davis Kane Architects PA, with a definite understanding that no money will be allowed for extra work except as set forth in the General Conditions and the contract documents. The low Bidder will be determined by the total cost of the Contract with the lump sum prices if the alternates accepted being added to or deducted from the Base Bid to give the total cost of the Contract. Bidders are required to be licensed and in good standing with their respective North Carolina Licensing Board.

SINGLE PRIME CONTRACT:

Base Bid:

Dollars(\$) _____

General Subcontractor:

Plumbing Subcontractor:

_____ Lic _____

_____ Lic _____

Mechanical Subcontractor:

Electrical Subcontractor:

_____ Lic _____

_____ Lic _____

GS143-128(d) requires all single prime bidders to identify their subcontractors for the above subdivisions of work. A contractor whose bid is accepted shall not substitute any person as subcontractor in the place of the subcontractor listed in the original bid, except (i) if the listed subcontractor's bid is later determined by the contractor to be non-responsible or non-responsive or the listed subcontractor refuses to enter into a contract for the complete performance of the bid work, or (ii) with the approval of the awarding authority for good cause shown by the contractor.

GENERAL CONSTRUCTION CONTRACT:

Base Bid:

Dollars(\$)

PLUMBING CONTRACT:

Base Bid:

Dollars(\$)

HEATING, VENTILATION AND AIR CONDITIONING CONTRACT:

Base Bid:

Dollars(\$)

ELECTRICAL CONTRACT:

Base Bid:

Dollars(\$)

ALTERNATES:

Should any of the alternates as described in the contract documents be accepted, the amount written below shall be the amount to be "added to" or "deducted from" the base bid. (Strike out "Add" or "Deduct" as appropriate.)

GENERAL CONTRACT:

Alternate 1:

(Add)

Dollars(\$)

Alternate 2:

(Add)

Dollars(\$)

Alternate 3:

(Add)

Dollars(\$)

UNIT PRICES

Unit prices quoted and accepted shall apply throughout the life of the contract, except as otherwise specifically noted. Unit prices shall be applied, as appropriate, to compute the total value of changes in the base bid and quantity of the work all in accordance with the contract documents.

GENERAL CONTRACT:

No. Q1 Rock removal in Open Areas, disposal off site	cubic yard	Unit Price (\$)
No. Q2 Rock removal in Trenches & Pits, disposal off site	cubic yard	Unit Price (\$)
No. Q3 Unsuitable soils removal and disposal off-site	cubic yard	Unit Price (\$)
No. Q4 Replacement of removed rock or unsuitable soils with off-site suitable soil in-place	cubic yard	Unit Price (\$)
No. Q5 Replacement of removed rock or unsuitable soils with Aggregate Base Course in-place.	cubic yard	Unit Price (\$)
No. Q6 Replacement of removed rock or unsuitable soils with No. 57 washed stone in-place	cubic yard	Unit Price (\$)
No. Q7 Impervious Clay Soil Liner at Constructed Stormwater Wetland in-place.	square yard	Unit Price (\$)
No. Q8 Woven Geo-Textile Fabric in-place	square yard	Unit Price (\$)
No. Q9 Biaxial Geo-Grid in-place	square yard	Unit Price (\$)
No. A1 Duplex receptacle	each	Unit Price (\$)
No. A2 Communication outlet	each	Unit Price (\$)
No. A3 Exit sign	each	Unit Price (\$)

The bidder further proposes and agrees hereby to commence work under this contract on a date to be specified in a written order of the designer and shall fully complete all work thereunder within the time specified in the Supplementary General Conditions Article 23. Applicable liquidated damages amount is also stated in the Supplementary General Conditions Article 23.

MINORITY BUSINESS PARTICIPATION REQUIREMENTS

Provide with the bid - Under GS 143-128.2(c) the undersigned bidder shall identify **on its bid** (Identification of Minority Business Participation Form) the minority businesses that it will use on the project with the total dollar value of the bids that will be performed by the minority businesses. **Also** list the good faith efforts (Affidavit A) made to solicit minority participation in the bid effort.

NOTE: A contractor that performs all of the work with its own workforce may submit an Affidavit (B) to that effect in lieu of Affidavit (A) required above. The MB Participation Form must still be submitted even if there is zero participation.
After the bid opening - The Owner will consider all bids and alternates and determine the lowest responsible, responsive bidder. Upon notification of being the apparent low bidder, the bidder shall then file within 72 hours of the notification of being the apparent lowest bidder, the following:

An Affidavit (C) that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, which is equal to or more than the 10% goal established. This affidavit shall give rise to the presumption that the bidder has made the required good faith effort and Affidavit D is not necessary;

*** OR ***

If less than the 10% goal, Affidavit (D) of its good faith effort to meet the goal shall be provided. The document must include evidence of all good faith efforts that were implemented, including any advertisements, solicitations and other specific actions demonstrating recruitment and selection of minority businesses for participation in the contract.

Note: Bidders must always submit **with their bid** the Identification of Minority Business Participation Form listing all MB contractors, vendors and suppliers that will be used. If there is no MB participation, then enter none or zero on the form. Affidavit A **or** Affidavit B, as applicable, also must be submitted with the bid. Failure to file a required affidavit or documentation with the bid or after being notified apparent low bidder is grounds for rejection of the bid.

Proposal Signature Page

The undersigned further agrees that in the case of failure on his part to execute the said contract and the bonds within ten (10) consecutive calendar days after being given written notice of the award of contract, the certified check, cash or bid bond accompanying this bid shall be paid into the funds of the owner's account set aside for the project, as liquidated damages for such failure; otherwise the certified check, cash or bid bond accompanying this proposal shall be returned to the undersigned. No proposal may be withdrawn after the scheduled closing time for the receipt of Bids for a period of sixty (60) days.

Respectfully submitted this day of _____

(Name of firm or corporation making bid)

WITNESS:

By: _____

Signature

(Proprietorship or Partnership)

Name: _____
Print or type

Title _____
(Owner/Partner/Pres./V.Pres)

Address _____

ATTEST:

By: _____

License No. _____

Title: _____
(Corp. Sec. or Asst. Sec. only)

Federal I.D. No. _____

Email Address: _____

(CORPORATE SEAL)

Addendum received and used in computing bid:

Addendum No. 1 _____ Addendum No. 3 _____ Addendum No. 5 _____ Addendum No. 6 _____

Addendum No. 2 _____ Addendum No. 4 _____ Addendum No. 6 _____ Addendum No. 7 _____

FORM OF BID BOND

KNOW ALL MEN BY THESE PRESENTS THAT _____
_____ as principal, and
_____, as surety, who is duly licensed to act as
surety in North Carolina, are held and firmly bound unto the Town of Farmville, North Carolina
through _____ as obligee, in the penal sum of
_____ DOLLARS, lawful money of the United
States of America, for the payment of which, well and truly to be made, we bind ourselves, our heirs,
executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

Signed, sealed and dated this _____ day of _____ 20__

WHEREAS, the said principal is herewith submitting proposal for and the principal desires
to file this bid bond in lieu of making the cash deposit as required by G.S. 143-129.

NOW, THEREFORE, THE CONDITION OF THE ABOVE OBLIGATION is such, that if
the principal shall be awarded the contract for which the bid is submitted and shall execute the
contract and give bond for the faithful performance thereof within ten days after the award of same to
the principal, then this obligation shall be null and void; but if the principal fails to so execute such
contract and give performance bond as required by G.S. 143-129, the surety shall, upon demand,
forthwith pay to the obligee the amount set forth in the first paragraph hereof. Provided further, that
the bid may be withdrawn as provided by G.S. 143-129.1

_____(SEAL)

_____(SEAL)

_____(SEAL)

_____(SEAL)

_____(SEAL)

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AIA® Document A201® – 2017

General Conditions of the Contract for Construction

for the following PROJECT:

(Name and location or address)

Farmville Fire Station & Headquarters
6101 May Blvd, Farmville, NC 27828

THE OWNER:

(Name, legal status and address)

Town of Farmville
3672 N Main Street, Farmville, NC 27828

THE ARCHITECT:

(Name, legal status and address)

Davis Kane Architects, PA
503 Oberlin Road, Suite 300

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ADDITIONS AND DELETIONS:

The author of this document may have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™–2017, Guide for Supplementary Conditions.

15 CLAIMS AND DISPUTES

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent

consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon written protocols governing the transmission and use of, and reliance on, Instruments of Service or any other information or documentation in digital form.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to written protocols governing the use of, and reliance on, the information contained in the model shall be at the using or relying party's

sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the

Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- .1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- .3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's

responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in

Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any

direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with

reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible

for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

- .1 The change in the Work;
- .2 The amount of the adjustment, if any, in the Contract Sum; and
- .3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or

.4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

- .1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
- .2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
- .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
- .5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term “day” as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor’s control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor’s Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor’s subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the

Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a Separate Contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented

to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- .1 liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents;

- .3 terms of special warranties required by the Contract Documents; or
- .4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

- .1 employees on the Work and other persons who may be affected thereby;
- .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
- .3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The

Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds

of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§ 11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the

other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- .1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- .3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance,

the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- .1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the

Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.

Additions and Deletions Report for

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There are no edits to the original text

Variable Information

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GUIDELINES FOR RECRUITMENT AND SELECTION OF MINORITY BUSINESSES FOR PARTICIPATION IN STATE CONSTRUCTION CONTRACTS

In accordance with G.S. 143-128.2 (effective January 1, 2002) these guidelines establish goals for minority participation in single-prime bidding, separate-prime bidding, construction manager at risk, and alternative contracting methods, on State construction projects in the amount of \$300,000 or more. The legislation provides that the State shall have a verifiable ten percent (10%) goal for participation by minority businesses in the total value of work for each project for which a contract or contracts are awarded. These requirements are published to accomplish that end.

SECTION A: INTENT

It is the intent of these guidelines that the State of North Carolina, as awarding authority for construction projects, and the contractors and subcontractors performing the construction contracts awarded shall cooperate and in good faith do all things legal, proper and reasonable to achieve the statutory goal of ten percent (10%) for participation by minority businesses in each construction project as mandated by GS 143-128.2. Nothing in these guidelines shall be construed to require contractors or awarding authorities to award contracts or subcontracts to or to make purchases of materials or equipment from minority-business contractors or minority-business subcontractors who do not submit the lowest responsible, responsive bid or bids.

SECTION B: DEFINITIONS

1. Minority - a person who is a citizen or lawful permanent resident of the United States and who is:
 - a. Black, that is, a person having origins in any of the black racial groups in Africa;
 - b. Hispanic, that is, a person of Spanish or Portuguese culture with origins in Mexico, South or Central America, or the Caribbean Islands, regardless of race;
 - c. Asian American, that is, a person having origins in any of the original peoples of the Far East, Southeast Asia and Asia, the Indian subcontinent, the Pacific Islands;
 - d. American Indian, that is, a person having origins in any of the original peoples of North America; or
 - e. Female
2. Minority Business - means a business:
 - a. In which at least fifty-one percent (51%) is owned by one or more minority persons, or in the case of a corporation, in which at least fifty-one percent (51%) of the stock is owned by one or more minority persons or socially and economically disadvantaged individuals; and
 - b. Of which the management and daily business operations are controlled by one or more of the minority persons or socially and economically disadvantaged individuals who own it.
3. Socially and economically disadvantaged individual - means the same as defined in 15 U.S.C. 637. "Socially disadvantaged individuals are those who have been subjected to racial or ethnic prejudice or cultural bias because of their identity as a member of a group without regard to their individual qualities". "Economically disadvantaged individuals are those socially disadvantaged individuals whose ability to compete in the free enterprise system has been impaired due to diminished capital and credit opportunities as compared to others in the same business area who are not socially disadvantaged".
4. Public Entity - means State and all public subdivisions and local governmental units.
5. Owner - The State of North Carolina, through the Agency/Institution named in the contract.
6. Designer - Any person, firm, partnership, or corporation, which has contracted with the State of North Carolina to perform architectural or engineering, work.
7. Bidder - Any person, firm, partnership, corporation, association, or joint venture seeking to be awarded a public contract or subcontract.

8. Contract - A mutually binding legal relationship or any modification thereof obligating the seller to furnish equipment, materials or services, including construction, and obligating the buyer to pay for them.
9. Contractor - Any person, firm, partnership, corporation, association, or joint venture which has contracted with the State of North Carolina to perform construction work or repair.
10. Subcontractor - A firm under contract with the prime contractor or construction manager at risk for supplying materials or labor and materials and/or installation. The subcontractor may or may not provide materials in his subcontract.

SECTION C: RESPONSIBILITIES

1. Office for Historically Underutilized Businesses, Department of Administration (hereinafter referred to as HUB Office).

The HUB Office has established a program, which allows interested persons or businesses qualifying as a minority business under G.S. 143-128.2, to obtain certification in the State of North Carolina procurement system. The information provided by the minority businesses will be used by the HUB Office to:

- a. Identify those areas of work for which there are minority businesses, as requested.
- b. Make available to interested parties a list of prospective minority business contractors and subcontractors.
- c. Assist in the determination of technical assistance needed by minority business contractors.

In addition to being responsible for the certification/verification of minority businesses that want to participate in the State construction program, the HUB Office will:

- (1) Maintain a current list of minority businesses. The list shall include the areas of work in which each minority business is interested.
- (2) Inform minority businesses on how to identify and obtain contracting and subcontracting opportunities through the State Construction Office and other public entities.
- (3) Inform minority businesses of the contracting and subcontracting process for public construction building projects.
- (4) Work with the North Carolina trade and professional organizations to improve the ability of minority businesses to compete in the State construction projects.
- (5) The HUB Office also oversees the minority business program by:
 - a. Monitoring compliance with the program requirements.
 - b. Assisting in the implementation of training and technical assistance programs.
 - c. Identifying and implementing outreach efforts to increase the utilization of minority businesses.
 - d. Reporting the results of minority business utilization to the Secretary of the Department of Administration, the Governor, and the General Assembly.

2. State Construction Office

The State Construction Office will be responsible for the following:

- a. Furnish to the HUB Office a minimum of twenty-one days prior to the bid opening the following:
 - (1) Project description and location;
 - (2) Locations where bidding documents may be reviewed;
 - (3) Name of a representative of the owner who can be contacted during the advertising period to advise who the prospective bidders are;
 - (4) Date, time and location of the bid opening.
 - (5) Date, time and location of prebid conference, if scheduled.
- b. Attending scheduled prebid conference, if necessary, to clarify requirements of the general statutes regarding minority-business participation, including the bidders' responsibilities.

- c. Reviewing the apparent low bidders' statutory compliance with the requirements listed in the proposal, that must be complied with, if the bid is to be considered as responsive, prior to award of contracts. The State reserves the right to reject any or all bids and to waive informalities.
- d. Reviewing of minority business requirements at Preconstruction conference.
- e. Monitoring of contractors' compliance with minority business requirements in the contract documents during construction.
- f. Provide statistical data and required reports to the HUB Office.
- g. Resolve any protest and disputes arising after implementation of the plan, in conjunction with the HUB Office.

3. Owner

Before awarding a contract, owner shall do the following:

- a. Develop and implement a minority business participation outreach plan to identify minority businesses that can perform public building projects and to implement outreach efforts to encourage minority business participation in these projects to include education, recruitment, and interaction between minority businesses and non-minority businesses.
- b. Attend the scheduled prebid conference.
- c. At least 10 days prior to the scheduled day of bid opening, notify minority businesses that have requested notices from the public entity for public construction or repair work and minority businesses that otherwise indicated to the Office for Historically Underutilized Businesses an interest in the type of work being bid or the potential contracting opportunities listed in the proposal. The notification shall include the following:
 - 1. A description of the work for which the bid is being solicited.
 - 2. The date, time, and location where bids are to be submitted.
 - 3. The name of the individual within the owner's organization who will be available to answer questions about the project.
 - 4. Where bid documents may be reviewed.
 - 5. Any special requirements that may exist.
- d. Utilize other media, as appropriate, likely to inform potential minority businesses of the bid being sought.
- e. Maintain documentation of any contacts, correspondence, or conversation with minority business firms made in an attempt to meet the goals.
- f. Review, jointly with the designer, all requirements of G.S. 143-128.2(c) and G.S. 143-128.2(f) – (i.e. bidders' proposals for identification of the minority businesses that will be utilized with corresponding total dollar value of the bid and affidavit listing good faith efforts, or affidavit of self-performance of work, if the contractor will perform work under contract by its own workforce) - prior to recommendation of award to the State Construction Office.
- g. Evaluate documentation to determine good faith effort has been achieved for minority business utilization prior to recommendation of award to State Construction Office.
- h. Review prime contractors' pay applications for compliance with minority business utilization commitments prior to payment.
- i. Make documentation showing evidence of implementation of Owner's responsibilities available for review by State Construction Office and HUB Office, upon request

4. Designer

Under the single-prime bidding, separate prime bidding, construction manager at risk, or alternative contracting method, the designer will:

- a. Attend the scheduled prebid conference to explain minority business requirements to the prospective bidders.
- b. Assist the owner to identify and notify prospective minority business prime and subcontractors of potential contracting opportunities.
- c. Maintain documentation of any contacts, correspondence, or conversation with minority business firms made in an attempt to meet the goals.
- d. Review jointly with the owner, all requirements of G.S. 143-128.2(c) and G.S. 143-128.2(f) – (i.e. bidders' proposals for identification of the minority businesses that will be utilized with

corresponding total dollar value of the bid and affidavit listing Good Faith Efforts, or affidavit of self-performance of work, if the contractor will perform work under contract by its own workforce) - prior to recommendation of award.

- e. During construction phase of the project, review “MBE Documentation for Contract Payment” – (Appendix E) for compliance with minority business utilization commitments. Submit Appendix E form with monthly pay applications to the owner and forward copies to the State Construction Office.
- f. Make documentation showing evidence of implementation of Designer’s responsibilities available for review by State Construction Office and HUB Office, upon request.

5. Prime Contractor(s), CM at Risk, and Its First-Tier Subcontractors

Under the single-prime bidding, the separate-prime bidding, construction manager at risk and alternative contracting methods, contractor(s) will:

- a. Attend the scheduled prebid conference.
- b. Identify or determine those work areas of a subcontract where minority businesses may have an interest in performing subcontract work.
- c. At least ten (10) days prior to the scheduled day of bid opening, notify minority businesses of potential subcontracting opportunities listed in the proposal. The notification will include the following:
 - (1) A description of the work for which the subbid is being solicited.
 - (2) The date, time and location where subbids are to be submitted.
 - (3) The name of the individual within the company who will be available to answer questions about the project.
 - (4) Where bid documents may be reviewed.
 - (5) Any special requirements that may exist, such as insurance, licenses, bonds and financial arrangements.

If there are more than three (3) minority businesses in the general locality of the project who offer similar contracting or subcontracting services in the specific trade, the contractor(s) shall notify three (3), but may contact more, if the contractor(s) so desires.

- d. During the bidding process, comply with the contractor(s) requirements listed in the proposal for minority participation.
- e. Identify on the bid, the minority businesses that will be utilized on the project with corresponding total dollar value of the bid and affidavit listing good faith efforts as required by G.S. 143-128.2(c) and G.S. 143-128.2(f).
- f. Make documentation showing evidence of implementation of PM, CM-at-Risk and First-Tier Subcontractor responsibilities available for review by State Construction Office and HUB Office, upon request.
- g. Upon being named the apparent low bidder, the Bidder shall provide one of the following: (1) an affidavit (Affidavit C) that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, which is equal to or more than the applicable goal; (2) if the percentage is not equal to the applicable goal, then documentation of all good faith efforts taken to meet the goal. Failure to comply with these requirements is grounds for rejection of the bid and award to the next lowest responsible and responsive bidder.
- h. The contractor(s) shall identify the name(s) of minority business subcontractor(s) and corresponding dollar amount of work on the schedule of values. The schedule of values shall be provided as required in Article 31 of the General Conditions of the Contract to facilitate payments to the subcontractors.
- i. The contractor(s) shall submit with each monthly pay request(s) and final payment(s), “MBE Documentation for Contract Payment” – (Appendix E), for designer’s review.
- j. During the construction of a project, at any time, if it becomes necessary to replace a minority business subcontractor, immediately advise the owner, State Construction Office, and the Director of the HUB Office in writing, of the circumstances involved. The prime contractor shall make a good faith effort to replace a minority business subcontractor with another minority business subcontractor.

- k. If during the construction of a project additional subcontracting opportunities become available, make a good faith effort to solicit subbids from minority businesses.
- l. It is the intent of these requirements apply to all contractors performing as prime contractor and first tier subcontractor under construction manager at risk on state projects.

6. Minority Business Responsibilities

While minority businesses are not required to become certified in order to participate in the State construction projects, it is recommended that they become certified and should take advantage of the appropriate technical assistance that is made available. In addition, minority businesses who are contacted by owners or bidders must respond promptly whether or not they wish to submit a bid.

SECTION 4: DISPUTE PROCEDURES

It is the policy of this state that disputes that involves a person's rights, duties or privileges, should be settled through informal procedures. To that end, minority business disputes arising under these guidelines should be resolved as governed under G.S. 143-128(g).

SECTION 5: These guidelines shall apply upon promulgation on state construction projects. Copies of these guidelines may be obtained from the Department of Administration, State Construction Office, (physical address) 301 North Wilmington Street, Suite 450, NC Education Building, Raleigh, North Carolina, 27601-2827, (mail address) 1307 Mail Service Center, Raleigh, North Carolina, 27699-1307, phone (919) 807-4100, Website: www.nc-sco.com

SECTION 6: In addition to these guidelines, there will be issued with each construction bid package provisions for contractual compliance providing minority business participation in the state construction program.

MINORITY BUSINESS CONTRACT PROVISIONS (CONSTRUCTION)

APPLICATION:

The **Guidelines for Recruitment and Selection of Minority Businesses for Participation in State Construction Contracts** are hereby made a part of these contract documents. These guidelines shall apply to all contractors regardless of ownership. Copies of these guidelines may be obtained from the Department of Administration, State Construction Office, (physical address) 301 North Wilmington Street, Suite 450, NC Education Building, Raleigh, North Carolina, 27601-2827, (mail address) 1307 Mail Service Center, Raleigh, North Carolina, 27699-1307, phone (919) 807-4100, Website: <http://www.nc-sco.com>

MINORITY BUSINESS SUBCONTRACT GOALS:

The goals for participation by minority firms as subcontractors on this project have been set at 10%.

The bidder must identify on its bid, the minority businesses that will be utilized on the project with corresponding total dollar value of the bid and affidavit (Affidavit A) listing good faith efforts or affidavit (Affidavit B) of self-performance of work, if the bidder will perform work under contract by its own workforce, as required by G.S. 143-128.2(c) and G.S. 143-128.2(f).

The lowest responsible, responsive bidder must provide Affidavit C, that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, which is equal to or more than the applicable goal.

OR

Provide Affidavit D, that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, **with documentation of Good Faith Effort, if the percentage is not equal to the applicable goal.**

OR

Provide Affidavit B, which includes sufficient information for the State to determine that the bidder does not customarily subcontract work on this type project.

The above information must be provided as required. Failure to submit these documents is grounds for rejection of the bid.

MINIMUM COMPLIANCE REQUIREMENTS:

All written statements, affidavits or intentions made by the Bidder shall become a part of the agreement between the Contractor and the State for performance of this contract. Failure to comply with any of these statements, affidavits or intentions, or with the minority business Guidelines shall constitute a breach of the contract. A finding by the State that any information submitted either prior to award of the contract or during the performance of the contract is inaccurate, false or incomplete, shall also constitute a breach of the contract. Any such breach may result in termination of the contract in accordance with the termination provisions contained in the contract. It shall be solely at the option of the State whether to terminate the contract for breach.

In determining whether a contractor has made Good Faith Efforts, the State will evaluate all efforts made by the Contractor and will determine compliance in regard to quantity, intensity, and results of these efforts. Good Faith Efforts include:

- (1) Contacting minority businesses that reasonably could have been expected to submit a quote and that were known to the contractor or available on State or local government maintained lists at least 10 days before the bid or proposal date and notifying them of the nature and scope of the work to be performed.
- (2) Making the construction plans, specifications and requirements available for review by prospective minority businesses, or providing these documents to them at least 10 days before the bid or proposals are due.
- (3) Breaking down or combining elements of work into economically feasible units to facilitate minority participation.
- (4) Working with minority trade, community, or contractor organizations identified by the Office for Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of minority businesses.
- (5) Attending any prebid meetings scheduled by the public owner.
- (6) Providing assistance in getting required bonding or insurance or providing alternatives to bonding or insurance for subcontractors.
- (7) Negotiating in good faith with interested minority businesses and not rejecting them as unqualified without sound reasons based on their capabilities. Any rejection of a minority business based on lack of qualification should have the reasons documented in writing.
- (8) Providing assistance to an otherwise qualified minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letters of credit, including waiving credit that is ordinarily required. Assisting minority businesses in obtaining the same unit pricing with the bidder's suppliers in order to help minority businesses in establishing credit.
- (9) Negotiating joint venture and partnership arrangements with minority businesses in order to increase opportunities for minority business participation on a public construction or repair project when possible.
- (10) Providing quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

APPENDIX E

MBE DOCUMENTATION FOR CONTRACT PAYMENTS

Prime Contractor/Architect: _____

Address & Phone: _____

Project Name: _____

Pay Application #: _____ Period: _____

The following is a list of payments made to Minority Business Enterprises on this project for the above-mentioned period.

MBE FIRM NAME	* INDICATE TYPE OF MBE	AMOUNT PAID THIS MONTH	TOTAL PAYMENTS TO DATE	TOTAL AMOUNT COMMITTED

*Minority categories: Black, African American (B), Hispanic (H), Asian American (A), American Indian (I), Female (F), Social and Economically Disadvantage (D)

Date: _____ Approved/Certified By: _____

Name

Title

Signature

SUBMIT WITH EACH PAY REQUEST & FINAL PAYMENT

Identification of HUB Certified/ Minority Business Participation

I, _____,
(Name of Bidder)

do hereby certify that on this project, we will use the following HUB Certified/ minority business as construction subcontractors, vendors, suppliers or providers of professional services.

Firm Name, Address and Phone #

Work Type

*Minority Category

**HUB
Certified
(Y/N)

[illegible]

*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

**** HUB Certification with the state HUB Office required to be counted toward state participation goals.**

The total value of minority business contracting will be (\$)_____.

State of North Carolina AFFIDAVIT A – Listing of Good Faith Efforts

County of _____

(Name of Bidder)

Affidavit of _____

I have made a good faith effort to comply under the following areas checked:

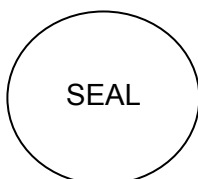
Bidders must earn at least 50 points from the good faith efforts listed for their bid to be considered responsive. (1 NC Administrative Code 30 I.0101)

- ☐ **1 – (10 pts)** Contacted minority businesses that reasonably could have been expected to submit a quote and that were known to the contractor, or available on State or local government maintained lists, at least 10 days before the bid date and notified them of the nature and scope of the work to be performed.
- ☐ **2 --(10 pts)** Made the construction plans, specifications and requirements available for review by prospective minority businesses, or providing these documents to them at least 10 days before the bids are due.
- ☐ **3 – (15 pts)** Broken down or combined elements of work into economically feasible units to facilitate minority participation.
- ☐ **4 – (10 pts)** Worked with minority trade, community, or contractor organizations identified by the Office of Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of minority businesses.
- ☐ **5 – (10 pts)** Attended prebid meetings scheduled by the public owner.
- ☐ **6 – (20 pts)** Provided assistance in getting required bonding or insurance or provided alternatives to bonding or insurance for subcontractors.
- ☐ **7 – (15 pts)** Negotiated in good faith with interested minority businesses and did not reject them as unqualified without sound reasons based on their capabilities. Any rejection of a minority business based on lack of qualification should have the reasons documented in writing.
- ☐ **8 – (25 pts)** Provided assistance to an otherwise qualified minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letters of credit, including waiving credit that is ordinarily required. Assisted minority businesses in obtaining the same unit pricing with the bidder's suppliers in order to help minority businesses in establishing credit.
- ☐ **9 – (20 pts)** Negotiated joint venture and partnership arrangements with minority businesses in order to increase opportunities for minority business participation on a public construction or repair project when possible.
- ☐ **10 - (20 pts)** Provided quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

The undersigned, if apparent low bidder, will enter into a formal agreement with the firms listed in the Identification of Minority Business Participation schedule conditional upon scope of contract to be executed with the Owner. Substitution of contractors must be in accordance with GS143-128.2(d) Failure to abide by this statutory provision will constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of the minority business commitment and is authorized to bind the bidder to the commitment herein set forth.

Date: _____ Name of Authorized Officer: _____
 Signature: _____
 Title: _____



State of _____, County of _____
 Subscribed and sworn to before me this _____ day of _____ 20____
 Notary Public _____
 My commission expires _____

State of North Carolina --AFFIDAVIT B-- Intent to Perform Contract with Own Workforce.

County of _____

Affidavit of _____
(Name of Bidder)

I hereby certify that it is our intent to perform 100% of the work required for the _____
_____ contract.
(Name of Project)

In making this certification, the Bidder states that the Bidder does not customarily subcontract elements of this type project, and normally performs and has the capability to perform and will perform all elements of the work on this project with his/her own current work forces; and

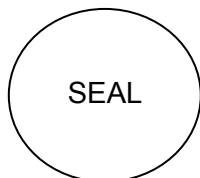
The Bidder agrees to provide any additional information or documentation requested by the owner in support of the above statement. The Bidder agrees to make a Good Faith Effort to utilize minority suppliers where possible.

The undersigned hereby certifies that he or she has read this certification and is authorized to bind the Bidder to the commitments herein contained.

Date: _____ Name of Authorized Officer: _____

Signature: _____

Title: _____



State of _____, County of _____

Subscribed and sworn to before me this _____ day of _____ 20____

Notary Public _____

My commission expires _____

State of North Carolina - AFFIDAVIT C - Portion of the Work to be Performed by HUB Certified/Minority Businesses

County of _____

(Note this form is to be submitted only by the apparent lowest responsible, responsive bidder.)

If the portion of the work to be executed by HUB certified/minority businesses as defined in GS143-128.2(g) and 128.4(a),(b),(e) is equal to or greater than 10% of the bidders total contract price, then the bidder must complete this affidavit.

This affidavit shall be provided by the apparent lowest responsible, responsive bidder within **72 hours** after notification of being low bidder.

Affidavit of _____ I do hereby certify that on the
(Name of Bidder)

(Project Name)
Project ID# _____ Amount of Bid \$ _____

I will expend a minimum of _____% of the total dollar amount of the contract with minority business enterprises. Minority businesses will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below.

Attach additional sheets if required

Name and Phone Number	*Minority Category	**HUB Certified Y/N	Work Description	Dollar Value

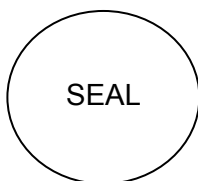
*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

**** HUB Certification with the state HUB Office required to be counted toward state participation goals.**

Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with Minority Firms for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the bidder to the commitment herein set forth.

Date: _____ Name of Authorized Officer: _____



Signature: _____

Title: _____

State of _____, County of _____

Subscribed and sworn to before me this _____ day of _____ 20____

Notary Public _____

My commission expires _____

State of North Carolina AFFIDAVIT D – Good Faith Efforts

County of _____

(Note this form is to be submitted only by the apparent lowest responsible, responsive bidder.)

If the goal of 10% participation by HUB Certified/ minority business **is not** achieved, the Bidder shall provide the following documentation to the Owner of his good faith efforts:

Affidavit of _____ I do hereby certify that on the _____
(Name of Bidder)

Project ID# _____ (Project Name) Amount of Bid \$ _____

I will expend a minimum of _____% of the total dollar amount of the contract with HUB certified/ minority business enterprises. Minority businesses will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below. (Attach additional sheets if required)

Name and Phone Number	*Minority Category	**HUB Certified Y/N	Work Description	Dollar Value

*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

**** HUB Certification with the state HUB Office required to be counted toward state participation goals.**

Examples of documentation that may be required to demonstrate the Bidder's good faith efforts to meet the goals set forth in these provisions include, but are not necessarily limited to, the following:

- Copies of solicitations for quotes to at least three (3) minority business firms from the source list provided by the State for each subcontract to be let under this contract (if 3 or more firms are shown on the source list). Each solicitation shall contain a specific description of the work to be subcontracted, location where bid documents can be reviewed, representative of the Prime Bidder to contact, and location, date and time when quotes must be received.
- Copies of quotes or responses received from each firm responding to the solicitation.
- A telephone log of follow-up calls to each firm sent a solicitation.
- For subcontracts where a minority business firm is not considered the lowest responsible sub-bidder, copies of quotes received from all firms submitting quotes for that particular subcontract.
- Documentation of any contacts or correspondence to minority business, community, or contractor organizations in an attempt to meet the goal.
- Copy of pre-bid roster
- Letter documenting efforts to provide assistance in obtaining required bonding or insurance for minority business.
- Letter detailing reasons for rejection of minority business due to lack of qualification.
- Letter documenting proposed assistance offered to minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letter of credit, including waiving credit that is ordinarily required.

Failure to provide the documentation as listed in these provisions may result in rejection of the bid and award to the next lowest responsible and responsive bidder.

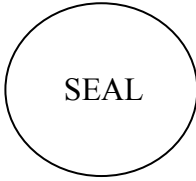
Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with Minority Firms for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the bidder to the commitment herein set forth.

Date: _____ Name of Authorized Officer: _____

Signature: _____

Title: _____



State of _____, County of _____

Subscribed and sworn to before me this _____ day of _____ 20____

Notary Public _____

My commission expires _____

CERTIFICATION REGARDING DEBARMENT AND SUSPENSION

The undersigned applicant certifies to the best of his or her knowledge and belief, that the applicant and its principals:

- (a) are not presently debarred, suspended, proposed for debarment, declared ineligible or voluntarily excluded from covered transactions by any Federal Department or agency;
- (b) have not within a 3-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
- (c) are not presently indicted or otherwise criminally or civilly charged by a governmental entitle (Federal, State, or local) with commission of any of the offenses enumerated in paragraph (b) of this certification; and
- (d) have not within a 3-year period preceding this application/proposal had one or more public transactions (Federal, State, or local) terminated for cause or default.

Where the prospective participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

Firm Name: _____

Address: _____

City/State/Zip: _____

Signature: _____

(Seal if Corporation)

Title: _____

Date: _____

NOTARIZE

SUBSCRIBED AND SWORN TO BEFORE ME,

This _____ day of _____, 202__

NOTARY PUBLIC _____

My Commission Expires: _____

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SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Contractor's use of site and premises.
4. Specification and Drawing conventions.

- B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

- A. Project Identification: Town of Farmville Fire Station & HQ.

1. Project Location: Farmville, North Carolina.

- B. Owner: Town of Farmville; Farmville, North Carolina.

- C. Architect: Davis Kane Architects, P.A.; Raleigh, North Carolina.

- D. Architect's Consultants: Architect has retained the following design professionals, who have prepared designated portions of the Contract Documents:

1. P.M.E Engineers: Atlantec Engineers, PA
2. Structural Engineer: Lynch Mykins Structural Engineers, PC
3. Civil Engineer: CLH Design, PA

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of the Project is defined by the Contract Documents and includes, but is not limited to, the following:

1. The Project is a new single-story fire station with up to five drive-thru apparatus bays, and other Work indicated in the Contract Documents.

B. Type of Contract:

1. Project will be constructed under a single prime contract.

1.5 OWNER-PROVIDED/CONTRACTOR-INSTALLED (OPCI) PRODUCTS

A. Owner's Responsibilities: Owner will furnish products indicated and perform the following, as applicable:

1. Provide Contractor Owner-reviewed Product Data, Shop Drawings and Samples.
2. Provide for delivery of Owner-furnished products to Project Site.
3. Upon Delivery, inspect, with contractor present, delivered items.
4. If owner-furnished products are damaged, defective or missing, arrange for replacement.
5. Obtain manufacturers inspections, service and warranties.
6. Inform contractor of earliest available delivery date for owner-furnished products.

B. Contractor's Responsibilities: The Work includes the following, as applicable:

1. Designate delivery dates of Owner-furnished products in the contractor's construction schedule, utilizing owner-furnished earlier delivery dates.
2. Review owner-furnished product data, shop drawings and samples, noting discrepancies and other issues in providing for owner-furnished products in the work.
3. Receive, unload, handle, store, protect, assemble and install owner-furnished products.
4. Make building services connections for owner-furnished products.
5. Protect Owner-furnished products from damage during storage, handling and installation and prior to substantial completion.

1.6 CONTRACTOR'S USE OF SITE AND PREMISES

A. Unrestricted Use of Site: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project Site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

B. Refer to specification section 011400 "Work Restrictions" for additional requirements.

1.7 COORDINATION WITH OCCUPANTS

A. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Final Acceptance of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of the equipment and limited occupancy shall not constitute acceptance of the total work.

1. Architect will provide a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed work.
2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited owner occupancy.
3. Before limited Owner Occupancy, mechanical and electrical systems shall be fully operational and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of work.

4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of work.

1.8 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings and published as part of the U.S. National CAD Standard.
 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

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SECTION - 011400 – WORK RESTRICTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Access to site.
 - 2. Work restrictions.
- B. Related Requirements:
 - 1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 ACCESS TO SITE

- A. General: Contractor shall have full use of Project site for construction operations during construction period. See restrictions below for specific use restrictions. Contractor's use of Project site is limited only by Owner's right to perform work and to retain other contractors on portions of Project.
 - 1. Limits: Limit site disturbance, including earthwork and clearing of vegetation, to project limits indicated on Drawings.
 - 2. Driveways, Walkways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.4 OWNER'S OCCUPANCY REQUIREMENTS

- A. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed areas of building, before Final Acceptance, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.
 - 1. CONTRACTOR shall prepare a Project Approval Authorization Partial Utilization: (Beneficial Occupancy) checklist for each specific portion of the Work to be occupied before Owner occupancy.

2. Prepare a Project Approval Authorization Partial Utilization: (Beneficial Occupancy) checklist for signature by the Designer, the Owning Agency and State Construction Office before Owner occupancy.
3. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of building.
4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.

1.5 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 1. Comply with limitations on the use of public streets and with other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Work shall only occur between the hours of 7:00 AM and 9:00 PM Monday-Saturday and between the hours of Noon and 7:00 PM on Sunday. Sunday work is discouraged but not prohibited.
- C. They shall post a sign indicating that "Firearms are prohibited on the Job Site."
- D. Dust Control. Any construction activities that create dust must be performed in a manner that does not allow dust to float or drift onto vehicles, other parts of the building or on any person visiting or working at the facility. Dust shall be controlled at all times. See Section 018113 Sustainability Requirements for additional indoor air quality requirements.
- E. Employee Background Verification: Criminal Background Investigations are required for individuals working on the project site. At a minimum, the contractor shall obtain a complete North Carolina statewide criminal background investigation for all employees and subcontractors who will work on this project, covering a period for the last seven (7) years. In the event that the contractor or subcontractor is from out of state, the criminal background investigation shall be broadened to include their home state, as well as the state of North Carolina as outlined above. The company providing such information must be recognized by local law enforcement agency as qualified to do so. All costs associated with these criminal background checks is the responsibility of the contractor.
 1. Any individual with the following criminal convictions or pending charges will NOT be permitted on project or property.
 - a. Child molestation.
 - b. Rape.
 - c. Any sexually-oriented crime.
 - d. Drugs: Felony use, possession or distribution.
- F. Employee Identification: Provide identification tags for Contractor personnel working on Project site. All contractor personnel shall wear approved ID badges at all times. Badges shall, at a minimum, legibly display the contractor name, firm, employee photo, and company phone number.
- G. Employee Conduct: Contractors, subcontractors, vendors, delivery staff and all assigns and related personnel shall conduct themselves professionally and in a non-harmful or threatening manner when on site. The following items are specific examples but do not necessarily represent all activities that might be cause for discipline or removal from campus.
 1. Indecent language, harassing statements or comments, whether or not directed to an individual, 'catcalls' or whistles, etc will not be tolerated. Violators will be removed from job site

immediately and not be allowed to return. Questioning or investigation into the matter will occur after removal from job site.

2. Proper dress is required. Shirts, long pants and shoes must be worn at all times. Clothing with offensive or provocative messages is not allowed. Loud music is not permitted.
3. Contractors personnel are prohibited from having fire arms, alcoholic beverages and/or drugs (except drugs prescribed by a physician for medical purposes of staff employed to work on the project) on the site. Violators will be reported to law enforcement.
4. Smoking is not allowed within 25 feet of the building after building enclosure is completed and may be prohibited if deemed a nuisance by the TOF.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011400

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SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements governing allowances.
 - 1. Certain items are specified in the Contract Documents by allowances. These allowances include installation.
 - 2. These allowances are for use only at the Owner's discretion for Work above and beyond that which is delineated and/or quantified elsewhere in the Contract Documents.
 - 3. The Work described in the Schedule of Allowances is identical to Work described elsewhere in the Contract Documents and the full requirements of the Contract Documents apply to the applicable Work described in the Schedule of Allowances.
- B. Types of allowances include the following:
 - 1. Unit-cost allowances.
 - 2. Quantity allowances.
 - 3. Contingency allowances.
- C. Related Requirements:
 - 1. Section 012200 "Unit Prices" for procedures for using unit prices, including adjustment of quantity allowances when applicable.
 - 2. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
 - 3. Section 014000 "Quality Requirements" for procedures governing the use of allowances for field testing by an independent testing agency.

1.3 DEFINITIONS

- A. Allowance: A quantity of work or dollar amount included in the Contract, established in lieu of additional requirements, used to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

1.4 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection, or purchase and delivery, of each product or system described by an allowance must be completed by the Owner to avoid delaying the Work.
- B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by Architect from the designated supplier.

1.5 ACTION SUBMITTALS

- A. Submit proposals for purchase of products or systems included in allowances in the form specified for Change Orders.

1.6 INFORMATIONAL SUBMITTALS

- A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.
- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.7 COORDINATION

- A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.
- B. Factor in time/schedule impacts as though allowances WILL be used in full.

1.8 ALLOWANCES ADMINISTRATIVE REQUIREMENTS

- A. Allowances Log: Prepare, maintain, and distribute a tabular log of allowances usage organized by the allowance number. Distribute current log at each Monthly Progress Meeting. Provide log with not less than the following information:
 - 1. Project name and number, including Owner project No.
 - 2. Name and address of Architect and Construction Manager.
 - 3. Summary page with each allowance number, description, unit quantity, unit price, and units used to date, allocated by Bid Package. Sum total dollar quantity remaining for each allowance.
 - 4. Within the Allowances Log, to support the Summary Page, track the date, description of use, and units used for each allowance or portion thereof utilized.

1.9 UNIT-COST ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight , and delivery to Project site.
- B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.
- C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
 - 1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.10 QUANTITY ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight , and delivery to Project site.
- B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.
- C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
 - 1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.11 CONTINGENCY ALLOWANCES

- A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.
- B. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation , taxes, insurance, equipment rental, and similar costs.
- C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit.
- D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

- A. Allowances includes material cost receiving, handling, and installation and Contractor overhead and profit.
- B. See Division 01 Section “Unit Prices” for complete descriptions of Work included under applicable Allowances
- C. Lump Sum Allowances

Item	Description	Amount	Bid Package(s)
LS1	Bi-Directional Antenna (BDA) System requirement evaluation and installation, as per notes and details on sheet SA001.	\$50,000	

- D. Unit-Cost Allowances

Item	Description	Unit	Unit Price	Bid Package(s)
UC1	Brick: Provide Brick Color as specified in Division 04 Section “Unit Masonry” for Brick Color 1	1000 Nominal	\$550	
UC2	Brick: Provide Brick Color as specified in Division 04 Section “Unit Masonry” for Brick Color 2	1000 Nominal	\$550	
UC3	Brick: Provide Brick Color as specified in Division 04 Section “Unit Masonry” for Brick Color 3	1000 Nominal	\$550	

E. Quantity Allowances

Item	Description	Unit	Unit Qty	Bid Package(s)
Q1	Rock removal in Open Areas (Mass Rock) and disposal off-site	Each Cubic Yard	10	
Q2	Rock removal in Trenches and Pits (Trench Rock) and disposal off-site	Each Cubic Yard	10	
Q3	Unsuitable soils removal and disposal on-site	Each Cubic Yard	1500	
Q4	Replacement of removed rock or unsuitable soils with on-site suitable soil in-place	Each Cubic Yard	750	
Q5	Replacement of removed rock or unsuitable soils with Aggregate Base Course in-place	Each Cubic Yard	500	
Q6	Replacement of removed rock or unsuitable soils with No.57 washed stone in-place	Each Cubic Yard	250	
Q7	Impervious Clay Soil Liner at Constructed Stormwater Wetland in-place.	Each Sq. Yard	1200	
Q8	Woven Geo-Textile Fabric in place	Each Sq. Yard	500	
Q9	Biaxial Geo-Grid in place	Each Sq. Yard	500	

END OF SECTION 012100

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SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for unit prices.
- B. Related Sections:
 - 1. Division 01 Section "Modification Procedures" for procedures for submitting and handling Change Proposals and Change Orders.
 - 2. Division 01 Section "Allowances" for Quantity Allowances related to unit prices.
 - 3. Division 01 Section "Quality Requirements" for field testing by an independent testing agency.

1.3 DEFINITIONS

- 1.4 Unit price is an amount incorporated into the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.5 PROCEDURES

- A. Unit prices include all necessary materials and labor, plus cost for delivery, freight installation, disposal, insurance, applicable taxes, overhead, and profit.
- B. The unit price provided by the Contractor shall be used for Work added or deducted to the contract.
- C. The Owner reserves the right to revise the quantities (increase or decrease) listed in the Allowances for any unit price Work utilizing the unit cost provided by the Contractor on the Bid Form.
- D. Unit prices shall apply throughout the life of the Contract, except as otherwise specifically noted.
- E. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor or soils and materials engineer acceptable to Contractor.

- F. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price. Bidders shall respond to the schedule by writing the applicable costs on the appropriate Bid Form for each identified unit cost.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

- A. Unit Price No. **Q1**: Rock removal in Open Areas (Mass Rock) and disposal off-site.
1. Purpose: To adjust the contract sum in case a quantity different from that indicated in the allowance is required.
 2. Unit of measurement: cubic yard measured before removal.
 3. Include the following in the unit price:
 - a. Excavation, loading, transport, and legal disposal of all materials.
 - b. All disposal fees.
 - c. Overhead and profit.
 4. Include all other related costs in the contract sum.
 5. Method of measurement: Quantities will be verified by a soils and materials engineer employed by the Owner.
 6. Quantity Allowance: Coordinate unit price with allowance adjustment requirements of Division 01 Section "Allowances."
 7. Allowance: 10-CY.
- B. Unit Price No. **Q2**: Rock removal in Trenches and Pits (Trench Rock) and disposal off-site.
1. Purpose: To adjust the contract sum in case a quantity different from that indicated in the allowance is required.
 2. Unit of measurement: cubic yard measured before removal.
 3. Include the following in the unit price:
 - a. Excavation, loading, transport, and legal disposal of all materials.
 - b. All disposal fees.
 - c. Overhead and profit.
 4. Include all other related costs in the contract sum.
 5. Method of measurement: Quantities will be verified by a soils and materials engineer employed by the Owner.
 6. Quantity Allowance: Coordinate unit price with allowance adjustment requirements of Division 01 Section "Allowances."
 7. Allowance: 10-CY.
- C. Unit Price No. **Q3**: Unsuitable soils removal and disposal off-site.
1. Purpose: To adjust the contract sum in case a quantity different from that indicated in the allowance is required.
 2. Unit of measurement: cubic yard measured before removal.
 3. Include the following in the unit price:
 - a. Excavation, loading, transport, and legal disposal of all materials.
 - b. All disposal fees.
 - c. Overhead and profit.

4. Include all other related costs in the contract sum.
 5. Method of measurement: Quantities will be verified by a soils and materials engineer employed by the Owner based on volume of excavation.
 6. Quantity Allowance: Coordinate unit price with allowance adjustment requirements of Division 01 Section "Allowances."
 7. Allowance: 1,500-CY.
- D. Unit Price No. **Q4**: Replacement of removed rock or unsuitable soils with off-site suitable soil in-place.
1. Purpose: To adjust the contract sum in case a quantity different from that indicated in the allowance is required.
 2. Unit of measurement: cubic yard of void to be filled.
 3. Include the following in the unit price:
 - a. Suitable soil materials from contractor's off-site source.
 - b. Excavation, loading, transport, placement and compaction of soil into void remaining from removed rock or unsuitable soil.
 - c. Overhead and profit.
 4. Include all other related costs in the contract sum.
 5. Include costs related to removal of rock or unsuitable soil in other Unit Prices.
 6. Method of measurement: Quantities will be verified by a soils and materials engineer employed by the Owner based on volume of void to be filled.
 7. Quantity Allowance: Coordinate unit price with allowance adjustment requirements of Division 01 Section "Allowances."
 8. Allowance: 750-CY.
- E. Unit Price No. **Q5**: Replacement of removed rock or unsuitable soils with Aggregate Base Course in-place.
1. Purpose: To adjust the contract sum in case a quantity different from that indicated in the allowance is required.
 2. Unit of measurement: cubic yard of void to be filled.
 3. Include the following in the unit price:
 - a. Certified ABC materials from contractor's off-site source.
 - b. Excavation, loading, transport, placement and compaction of ABC into void remaining from removed rock or unsuitable soil.
 - c. Overhead and profit.
 4. Include all other related costs in the contract sum.
 5. Include costs related to removal of rock or unsuitable soil in other Unit Prices.
 6. Method of measurement: Quantities will be verified by a soils and materials engineer employed by the Owner based on volume of void to be filled.
 7. Quantity Allowance: Coordinate unit price with allowance adjustment requirements of Division 01 Section "Allowances."
 8. Allowance: 500-CY.
- F. Unit Price No. **Q6**: Replacement of removed rock or unsuitable soils with No.57 washed stone in-place.
1. Purpose: To adjust the contract sum in case a quantity different from that indicated in the allowance is required.
 2. Unit of measurement: cubic yard of void to be filled.
 3. Include the following in the unit price:
 - a. Certified #57 washed stone from contractor's off-site source.

- b. Excavation, loading, transport, placement and compaction of #57 washed stone into void remaining from removed rock or unsuitable soil.
 - c. Overhead and profit.
 - 4. Include all other related costs in the contract sum.
 - 5. Include costs related to removal of rock or unsuitable soil in other Unit Prices.
 - 6. Method of measurement: Quantities will be verified by a soils and materials engineer employed by the Owner based on volume of void to be filled.
 - 7. Quantity Allowance: Coordinate unit price with allowance adjustment requirements of Division 01 Section "Allowances."
 - 8. Allowance: 250-CY.
- G. Unit Price No. **Q7**: Impervious Clay Soil Liner at Constructed Stormwater Wetland in-place.
 - 1. Purpose: To adjust the contract sum in case a quantity different from that indicated in the allowance is required.
 - 2. Unit of measurement: square yard of surface to be covered.
 - 3. Include the following in the unit price:
 - a. Impervious clay fill materials from contractor's off-site source.
 - b. Excavation of existing soil to accommodate placement of the clay soil liner.
 - c. Loading, transport, placement, fine grading and compaction of a 6-inch thick layer of clay soil the Constructed Stormwater Wetland.
 - d. Overhead and profit.
 - 4. Include all other related costs in the contract sum.
 - 5. Method of measurement: Quantities will be verified by a soils and materials engineer employed by the Owner based on surface area covered.
 - 6. Quantity Allowance: Coordinate unit price with allowance adjustment requirements of Division 01 Section "Allowances."
 - 7. Allowance: 1,200-SY.
- H. Unit Price No. **Q8**: Woven Geo-Textile Fabric in place.
 - 1. Purpose: To adjust the contract sum in case a quantity different from that indicated in the allowance is required.
 - 2. Unit of measurement: square yard of surface to be covered.
 - 3. Include the following in the unit price:
 - a. Materials and transport to site.
 - b. Unloading, handling, and placement.
 - c. Overhead and profit.
 - 4. Include all other related costs in the contract sum.
 - 5. Method of measurement: Quantities will be verified by a soils and materials engineer employed by the Owner based on the area of ground covered by the fabric. Excess and/or overlap shall not be included in the measurement.
 - 6. Quantity Allowance: Coordinate unit price with allowance adjustment requirements of Division 01 Section "Allowances."
 - 7. Allowance: 500-SY.
- I. Unit Price No. **Q9**: Biaxial Geo-Grid in place.
 - 1. Purpose: To adjust the contract sum in case a quantity different from that indicated in the allowance is required.
 - 2. Unit of measurement: square yard of surface to be covered.
 - 3. Include the following in the unit price:
 - a. Materials and transport to site.
 - b. Unloading, handling, and placement.

- c. Overhead and profit.
- 4. Include all other related costs in the contract sum.
- 5. Method of measurement: Quantities will be verified by a soils and materials engineer employed by the Owner based on the area of ground covered by the fabric. Excess and/or overlap shall not be included in the measurement.
- 6. Quantity Allowance: Coordinate unit price with allowance adjustment requirements of Division 01 Section "Allowances."
- 7. Allowance: 500-SY.
- J. Unit Price No. A1: Duplex receptacle.
 - 1. Description: Provide and install duplex receptacle including up to 30 feet of all required concealed conduit, wiring, fittings and connections for a functioning device. As further described in Section 262726 – Wiring Devices.
 - 2. Unit of measurement: Each.
- K. Unit Price No. A2: Communication outlet.
 - 1. Description: Provide and install communication outlet box (sized for 2 data drops) including up to 30 feet of concealed conduit, fittings and connections stubbed to accessible ceiling. As further described in Section 260533 – Boxes and Cabinets and Section 260545 – Conduit and Conduit Fittings.
 - 2. Unit of measurement: Each.
- L. Unit Price No. A3: Exit light.
 - 1. Description: Provide and install exit light including up to 30 feet of all required concealed conduit, wiring, fittings and connections for a functioning device. As further described on Sheet E100.
 - 2. Unit of measurement: Each.

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SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include, as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation, whether or not indicated as part of alternate.
- B. Execute accepted alternates under the same conditions as other Work of the Contract.
- C. Schedule: A Part 3 "Schedule of Alternates" Article is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1: Standing-Seam Metal Roof Panels.

1. Base Bid: Provide asphalt shingles as indicated on the Drawings and as specified in Section 073113 "Asphalt Shingles."
2. Alternate: In lieu of asphalt shingles, provide standing-seam metal roof panels as specified in Section 074113.16 "Standing-Seam Metal Roof Panels."

B. Alternate No. 2: Aluminum Glass Overhead Doors

1. Base Bid: Provide sectional steel overhead doors at apparatus bays as indicated on Drawings and as specified in Section 083613 "Sectional Doors".
2. Alternate: In lieu of steel overhead doors, provide aluminum glass overhead doors as specified in Section 083613 "Sectional Doors".

C. Alternate No. 3: Prefinished Extruded Aluminum Canopies at Apparatus Bay Overhead Doors

1. Base Bid: Canopies are not included at Apparatus Bay Overhead doors in Base Bid.
2. Alternate: Provide prefinished extruded aluminum canopies above apparatus bay overhead doors as indicated on drawings and as specified in section 105300 "Aluminum Canopies".

END OF SECTION 012300

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

- A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use form that is part of web-based Project management software, CSI Form 13.1A, or comparable form as acceptable to the Architect.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
 - b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.

- c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
 - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
 - j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
 - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.7 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

- 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

- a. Requested substitutions is a no-cost change or a credit.
 - b. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - c. Substitution request is fully documented and properly submitted.
 - d. Requested substitution will not adversely affect Contractor's construction schedule.
 - e. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - f. Requested substitution is compatible with other portions of the Work.
 - g. Requested substitution has been coordinated with other portions of the Work.
 - h. Requested substitution provides specified warranty.
 - i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

- B. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.

- 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

- a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Substitution request is fully documented and properly submitted.

- e. Requested substitution will not adversely affect Contractor's construction schedule.
- f. Requested substitution has received necessary approvals of authorities having jurisdiction.
- g. Requested substitution is compatible with other portions of the Work.
- h. Requested substitution has been coordinated with other portions of the Work.
- i. Requested substitution provides specified warranty.
- j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.3 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time.

1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within 21 days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include appropriate credit for any work of the contract no longer required as a result of the proposed change.
 - e. Include amounts reflecting overhead and profit, as addressed in the GC of the contract.
 - f. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - g. Quotation Form: Use forms acceptable to Architect.

- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 4. Include costs of labor and supervision directly attributable to the change.
 5. Include appropriate credit for any work of the contract no longer required as a result of the proposed change.
 6. Include amounts reflecting overhead and profit, as addressed in the GC of the contract.
 7. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 8. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
 9. Proposal Request Form: Use form acceptable to Architect or form provided as part of web-based Project management software.

1.5 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Change Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on form provided as part of web-based Project management software, AIA Document G714, or comparable form acceptable to the Architect. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

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SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
 - 1. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 2. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.
 - 3. Section 012100 "Allowances" for allowances and contingencies for the project.
 - 4. Section 012200 "Unit Prices" for unit pricing to be upheld by the contractor.

1.3 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's construction schedule. Cost-loaded Critical Path Method Schedule shall serve to satisfy requirements for the schedule of values.
 - 1. Coordinate line items in the Schedule of Values with items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of Values to Architect at earliest possible date, but no later than 21 calendar days after the Notice to Proceed.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.
 - 1. Identification: Include the following Project identification on the Schedule of Values:

- a. Project name and location.
 - b. Owner's name.
 - c. Owner's Project number.
 - d. Name of Architect.
 - e. Architect's Project number.
 - f. Contractor's name and address.
 - g. Date of submittal.
2. Arrange the Schedule of Values in tabular form, with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Dollar value for each activity identified in the construction schedule. Round dollar amounts to whole dollars, with total equal to Contract Sum.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.
3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Include separate line items under principal subcontracts for materials and labor for individual activities and separate line items for the following:
 - a. Allowances
 - b. Change Orders
 - c. Performance and Payment Bonds
 - d. Permits
 - e. Insurance
4. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site.
5. For allowances, show line item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the contract documents to determine quantities.
6. Overhead Costs, Proportional Distribution: Include total cost and proportionate share of general overhead and profit for each line item.
7. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.

8. Schedule of Values Revisions: Revise the Schedule of Values when Change Orders or result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments, as certified by Architect and paid for by Owner.
- B. Payment Application Times: Submit Application for Payment to Architect by the 20th of the month. The period covered by each Application for Payment is one month, ending on 15th of the month.
 1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.
- C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
 1. With each Application for payment, submit the following with the Owner Project Identification Number on each document:
 - a. Appendix E – MBE Documentation for Contract Payments.
 - b. State of North Carolina County Sales and Use Tax Report.
 - c. State of North Carolina Sales and Use Tax Report Detail.
 - d. Updated Project Construction Schedule.
 - e. Current Insurance Certificate.
 - f. Waste Management Log
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
 1. Entries shall match data on the Schedule of Values and Contractor's construction schedule. Use updated schedules if revisions were made.
 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 3. Include amounts of Change Orders issued before last day of construction period covered by application.
 4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
- E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
 1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for off site stored materials.
 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 3. Provide summary documentation for stored materials indicating the following:

- a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- F. Transmittal: Submit one printed signed copy and one electronic copy of each Application for Payment to Architect by a method ensuring receipt within 24 hours. It should include waivers of lien and similar attachments if required.
 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 2. When an application shows completion of an item, submit conditional final or full waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.
- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
 1. List of subcontractors.
 2. Schedule of Values.
 3. Contractor's construction schedule (preliminary if not final).
 4. Schedule of unit prices.
 5. Submittal schedule (preliminary if not final).
 6. List of Contractor's staff assignments.
 7. Copies of building permits.
 8. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 9. Initial progress report.
 10. Report of preconstruction conference.
 11. Certificates of insurance and insurance policies, if not submitted before executing the Contract.
 12. Performance and payment bonds, if not submitted before executing the Contract.
 13. Data needed to acquire Owner's insurance, if not submitted before executing the Contract.

- I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
 1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 - a. Complete administrative actions, submittals, and Work preceding this application, as described in Section 017700 "Closeout Procedures."
 2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
 1. Evidence of completion of Project closeout requirements.
 2. Certification of completion of final punch list items.
 3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 4. Updated final statement, accounting for final changes to the Contract Sum.
 5. AIA Document G706, or comparable form as approved by the Architect.
 6. AIA Document G706A, or comparable form as approved by the Architect.
 7. AIA Document G707, or comparable form as approved by the Architect.
 8. Evidence that claims have been settled.
 9. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 10. Final liquidated damages settlement statement.
 11. Proof that taxes, fees, and similar obligations are paid.
 12. Waivers and releases.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

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SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project, including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. RFIs.
 - 4. Digital project management procedures.
 - 5. Web-based Project management software package.
 - 6. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- C. Related Requirements:
 - 1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
 - 2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

- A. BIM: Building Information Modeling.
- B. RFI: Request for Information. Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Company, Name, address, telephone number, and email address of entity performing subcontract or supplying products.
 2. Number and title of related Specification Section(s) covered by subcontract.
- B. Key Personnel Names: Within 7 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses, cellular telephone numbers, and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
1. Post copies of list in Project meeting room, in temporary field office, in web-based Project software directory, and in prominent location in built facility. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.
1. Schedule construction operations in sequence required to obtain the best results, where installation of one part of the Work depends on installation of other components, before or after its own installation.
 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's construction schedule.
 2. Preparation of the schedule of values.
 3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Preinstallation conferences.
 7. Project closeout activities.
 8. Startup and adjustment of systems.

1.6 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
 - b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
 - c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
 - e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
 - f. Indicate required installation sequences.
 - g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:
1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
 2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.

3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
 4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
 5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
 6. Mechanical and Plumbing Work: Show the following:
 - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
 - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
 - c. Fire-rated enclosures around ductwork.
 7. Electrical Work: Show the following:
 - a. Runs of vertical and horizontal conduit 1-1/4 inches (32 mm) in diameter and larger.
 - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
 - c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
 - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
 8. Fire-Protection System: Show the following:
 - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
 9. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.
 10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 013300 "Submittal Procedures."
- C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:

1. File Submittal Format: Submit or post coordination drawing files using format same as file preparation format and Portable Data File (PDF) format.

1.7 REQUEST FOR INFORMATION (RFI)

- A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
 1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
 2. Coordinate and submit RFIs in a prompt manner to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
 1. Project name.
 2. Owner name.
 3. Owner's Project number.
 4. Name of Architect.
 5. Architect's Project number.
 6. Date.
 7. Name of Contractor.
 8. RFI number, numbered sequentially.
 9. RFI subject.
 10. Specification Section number and title and related paragraphs, as appropriate.
 11. Drawing number and detail references, as appropriate.
 12. Field dimensions and conditions, as appropriate.
 13. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 14. Contractor's signature.
 15. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: On web-based Project Management Software, AIA Document G716, or comparable form as acceptable to the Architect.
 1. Attachments shall be electronic files in PDF, Microsoft Excel, or Microsoft Word format.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow 3 business days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
 1. The following Contractor-generated RFIs will be returned without action:

- a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Architect's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 3 days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use software log that is part of web-based Project management software, or software log with not less than the following:
 1. Project name.
 2. Name and address of Contractor.
 3. Name and address of Architect.
 4. RFI number, including RFIs that were returned without action or withdrawn.
 5. RFI description.
 6. Date the RFI was submitted.
 7. Date Architect's response was received.
 8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.

1.8 DIGITAL PROJECT MANAGEMENT PROCEDURES

- A. Use of Architect's Digital Data Files: Digital data files of Architect's BIM model or CAD drawings may be provided by Architect for Contractor's use during construction.
 1. Digital data files may be used by Contractor in preparing coordination drawings.
 2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
 3. Contractor shall execute a data licensing agreement in the form of AIA Document C106 Digital Data Licensing Agreement or comparable agreement form acceptable to Owner and Architect.

- a. Subcontractors and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of AIA Document C106 or comparable agreement acceptable to Owner and Architect.
- B. Web-Based Project Management Software Package: The Contractor shall provide, administer, and use web-based Project management software package for purposes of hosting and managing Project communication and documentation until Final Completion.
 1. Web-based Project management software includes, at a minimum, the following features:
 - a. Compilation of Project data, including Contractor, subcontractors, Architect, Architect's consultants, Owner, and other entities involved in Project. Include names of individuals and contact information.
 - b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
 - c. Document workflow planning, allowing customization of workflow between project entities.
 - d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, and submittals.
 - e. Track status of each Project communication in real time, and log time and date when responses are provided.
 - f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
 - g. Processing and tracking of contract modifications.
 - h. Creating and distributing meeting minutes.
 - i. Document management for Drawings, Specifications, and coordination drawings, including revision control.
 - j. Management of construction progress photographs.
 - k. Mobile device compatibility, including smartphones and tablets.
 2. Provide up to ten Project management software user licenses for use of Owner, Architect, and Architect's consultants. Provide eight hours of software training at Architect's office for web-based Project software users as needed.
 3. At completion of Project, provide digital archive in format that is readable by common desktop software applications in format acceptable to Architect. Provide data in locked format to prevent further changes.
- C. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:
 1. Assemble complete submittal package into a single indexed file, incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 2. Name file with submittal number or other unique identifier, including revision identifier.
 3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.9 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
 - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times a minimum of seven days prior to meeting.
 - 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 - 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
- B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
 - 1. Attendees: Authorized representatives of Owner Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Responsibilities and personnel assignments.
 - b. Tentative construction schedule.
 - c. Phasing.
 - d. Critical work sequencing and long lead items.
 - e. Designation of key personnel and their duties.
 - f. Lines of communications.
 - g. Use of web-based Project software.
 - h. Procedures for processing field decisions and Change Orders.
 - i. Procedures for RFIs.
 - j. Procedures for testing and inspecting.
 - k. Procedures for processing Applications for Payment.
 - l. Distribution of the Contract Documents.
 - m. Submittal procedures.
 - n. Preparation of Record Documents.
 - o. Use of the premises.
 - p. Work restrictions.
 - q. Working hours.
 - r. Owner's occupancy requirements.
 - s. Responsibility for temporary facilities and controls.
 - t. Procedures for moisture and mold control.
 - u. Procedures for disruptions and shutdowns.
 - v. Construction waste management and recycling.
 - w. Parking availability.
 - x. Office, work, and storage areas.
 - y. Equipment deliveries and priorities.
 - z. First aid.
 - aa. Security.
 - bb. Progress cleaning.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other Sections and when required for coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility requirements.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written instructions.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
 2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of Record Documents.
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - c. Procedures for completing and archiving web-based Project software site data files.
 - d. Submittal of written warranties.
 - e. Requirements for completing sustainable design documentation.
 - f. Requirements for preparing operations and maintenance data.
 - g. Requirements for delivery of material samples, attic stock, and spare parts.
 - h. Requirements for demonstration and training.
 - i. Preparation of Contractor's punch list.
 - j. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - k. Submittal procedures.
 - l. Owner's partial occupancy requirements.
 - m. Installation of Owner's furniture, fixtures, and equipment.
 - n. Responsibility for removing temporary facilities and controls.
 4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: Conduct progress meetings every two weeks as approved by the Architect.
1. Coordinate dates of meetings with preparation of payment requests.
 2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:

- 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site use.
 - 8) Temporary facilities and controls.
 - 9) Progress cleaning.
 - 10) Quality and work standards.
 - 11) Status of correction of deficient items.
 - 12) Field observations.
 - 13) Status of RFIs.
 - 14) Status of Proposal Requests.
 - 15) Pending changes.
 - 16) Status of Change Orders.
 - 17) Pending claims and disputes.
 - 18) Documentation of information for payment requests.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
- a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
- F. Coordination Meetings: Conduct Project coordination meetings at regular intervals as approved by the Architect. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
 - c. Review present and future needs of each contractor present, including the following:

- 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site use.
 - 8) Temporary facilities and controls.
 - 9) Work hours.
 - 10) Hazards and risks.
 - 11) Progress cleaning.
 - 12) Quality and work standards.
 - 13) Status of RFIs.
 - 14) Proposal Requests.
 - 15) Change Orders.
 - 16) Pending changes.
3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Startup construction schedule.
 - 2. Contractor's Construction Schedule.
 - 3. Construction schedule updating reports.
 - 4. Daily construction reports.
 - 5. Material location reports.
 - 6. Site condition reports.
 - 7. Unusual event reports.
- B. Related Requirements:
 - 1. Section 014000 "Quality Requirements" for schedule of tests and inspections.
 - 2. Section 012900 "Payment Procedures" for schedule of values and requirements for use of cost-loaded schedule for Applications for Payment.
 - 3. Section 013300 "Submittals" for procedures and requirements for the submittal process.
 - 4. Section 017700 "Closeout Procedures" for procedures and requirements for closeout documentation.

1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: The allocation of the schedule of values for completing an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum.

- C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine the critical path of Project and when activities can be performed.
- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- E. Event: The starting or ending point of an activity.
- F. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
 - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- G. Resource Loading: The allocation of manpower and equipment necessary for completing an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in one of the following formats as acceptable to the Architect:
 - 1. Working electronic copy of schedule file.
 - 2. PDF file.
 - 3. Two paper copies, of sufficient size to display entire period or schedule, as required.
- B. Startup construction schedule.
 - 1. Submittal of cost-loaded startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.
- C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
 - 1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.
- E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

1. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for each activity, sorted in ascending order by activity number and then by early start date, or actual start date if known.
3. Total Float Report: List of activities sorted in ascending order of total float.
4. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment.

F. Construction Schedule Updating Reports: Submit with Applications for Payment.

G. Daily Construction Reports: Submit at weekly intervals.

H. Material Location Reports: Submit at weekly intervals.

I. Site Condition Reports: Submit at time of discovery of differing conditions.

J. Unusual Event Reports: Submit at time of unusual event.

1.5 QUALITY ASSURANCE

A. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's Construction Schedule, including, but not limited to, the following:

1. Review software limitations and content and format for reports.
2. Verify availability of qualified personnel needed to develop and update schedule.
3. Discuss constraints, including work stages, area separations, and interim milestones.
4. Review delivery dates for Owner-furnished products.
5. Review schedule for work of Owner's separate contracts.
6. Review submittal requirements and procedures.
7. Review time required for review of submittals and resubmittals.
8. Review requirements for tests and inspections by independent testing and inspecting agencies.
9. Review time required for Project closeout and Owner startup procedures.
10. Review and finalize list of construction activities to be included in schedule.
11. Review procedures for updating schedule.

1.6 COORDINATION

A. Coordinate Contractor's Construction Schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities, and schedule them in proper sequence.

1.7 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.
- B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.
 - 1. Schedule shall be prepared using Calander days for complete schedule and each activity.
 - 2. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- C. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
 - 1. Activity Duration: Define activities so no activity is longer than 14 days, unless specifically allowed by Architect.
 - 2. Temporary Facilities: Indicate start and completion dates for the following as applicable:
 - a. Securing of approvals and permits required for performance of the Work.
 - b. Temporary facilities.
 - c. Construction of mock-ups, prototypes and samples.
 - d. Owner interfaces and furnishing of items.
 - e. Interfaces with Separate Contracts.
 - f. Regulatory agency approvals.
 - g. Punch list.
 - 3. Procurement Activities: Include procurement process activities for the following long lead-time items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - 4. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
 - 5. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
 - 6. Commissioning Time: Include no fewer than 15 days for commissioning.
 - 7. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
 - 8. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and Final Completion.
- D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
 - 1. Products Ordered in Advance: Include a separate activity for each product. Delivery dates indicated stipulate the earliest possible delivery date.
 - 2. Owner Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary". Delivery dates indicated stipulate the earliest possible delivery date.
 - 3. Work Restrictions: Show the effect of the following items on the schedule:

- a. Limitations of continued occupancies.
 - b. Uninterruptible services.
 - c. Use-of-premises restrictions.
 - d. Provisions for future construction.
 - e. Seasonal variations.
 - f. Environmental control.
4. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Mockups.
 - e. Fabrication.
 - f. Sample testing.
 - g. Deliveries.
 - h. Installation.
 - i. Tests and inspections.
 - j. Adjusting.
 - k. Curing.
 - l. Building flush-out.
 - m. Startup and placement into final use and operation.
 - n. Commissioning
5. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
 - a. Structural completion.
 - b. Permanent space enclosure.
 - c. Completion of mechanical installation.
 - d. Completion of electrical installation.
 - e. Substantial Completion.
- E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.
- F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
 1. Unresolved issues.
 2. Unanswered Requests for Information.
 3. Rejected or unreturned submittals.
 4. Notations on returned submittals.
 5. Pending modifications affecting the Work and the Contract Time.
- G. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 3. As the Work progresses, indicate Final Completion percentage for each activity.
- H. Recovery Schedule: When periodic update indicates the Work is 5 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.
1. If the Contractor falls five (5) calendar days behind on any activity on the critical path shown on the Schedule or, if it becomes apparent from the Schedule that the Work might not be completed within the Contract Time or milestone dates might not be achieved as scheduled, the Contractor agrees to take, at no additional cost to the Owner, some or all of the following actions to recover the Schedule:
 - a. Increase the number of employees in such trades as shall regain lost schedule progress.
 - b. Increase the number of working hours per shift, shifts per working day, working days per week, amount of equipment or any combination of the foregoing to regain lost schedule progress.
 - c. In addition, the Contractor shall prepare and submit a Recovery Schedule demonstrating the Contractor's program and proposed plan to regain lost schedule progress and to ensure completion of the Work with the Contract Time and in accordance with the Schedule. Upon approval by the Owner and Architect, the Recovery Schedule shall become a part of the Schedule. All costs related to the preparation of any Recovery Schedule shall be borne by the Contractor.
 - d. Failure of the Contractor to comply with the requirements of subparagraphs a., b., or c. above or the Contractor's failure to diligently prosecute the Work so as to ensure its completion within the Contract Time is sufficient grounds to constitute a substantial breach of the Contract Documents
 2. Should any revision of any Progress Schedule show that the Contractor is behind so that, without increasing his rate of performance, he will not complete any activity, the late completion of which could delay Final Acceptance of the Work, the Owner shall be entitled to withhold from the next Progress Payment due the Contractor an amount not exceeding the amount the Owner would be entitled to in Liquidated Damages, should the Contractor delay Final Acceptance by the same number of days as he is behind, as shown in the most recent update/revision to the Progress/Schedule. Withholding of such funds shall be under the provisions of the General Conditions of the Contract, Article 33, Paragraph a.3. If, subsequently, the Contractor's progress, as shown by a succeeding revision to the Progress Schedule, is such that the anticipated delay no longer exists, the Owner shall pay with the Progress Payment next due to the Contractor such amounts as have been withheld in accordance with this paragraph.
- I. Each construction activity in the Schedule shall contain as a minimum, but shall not be limited to, description, duration, trade, area/floor, and relationship to other elements of the project. The work shall be categorized into activities of a duration no longer than fourteen (14) calendar days each, except for non-construction activities.

- J. Float time is the amount of time between the earliest start date and the latest start date or between the earliest finish date and the latest finish date of activities shown on the Schedule. For the purpose of this project, the Owner and Contractor specifically agree that float time shown in the approved Construction Schedule is not for the exclusive benefit of either the Contractors or the Owner and is available for use by whichever party needs the float to facilitate the effective use of available resources and to minimize the impact of unforeseen problems in execution of the Work. There will be no basis for an extension of Contract Time, or a claim for additional compensation as a result of any project Change Order or delay which only results in the loss of available positive float in activities of the approved Construction Schedule.
- K. Any request for extension of Contract Time shall include a proposed revised CPM Construction Schedule showing how the requested time extension alters the approved CPM Construction Schedule. The Contractor shall prepare the revised schedule, which must clearly display that the Contractor has used, in full, all of the float time available for the work involved in this request. The cost of such preparation will be borne by the Contractor. Upon approval by the Architect and Owner, the proposed revised schedule will be incorporated into the CPM Construction Schedule.
- L. If the Contractor at any time knows or has reason to believe that the delivery of any item of material or equipment or the storage of qualified labor or delays caused by others or the occurrence of any other difficulty may cause a delay in carrying out the approved Order of Construction or the Progress Schedule, he shall notify the Architect in writing within three (3) days.
- M. Any work necessary to be performed after regular hours, on Sundays, or Legal Holidays, shall be performed without additional expense to the Owner, unless it is a Change in Work with an approved Time Extension or acceleration.
- N. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
 - 1. Post copies in Project meeting rooms and temporary field offices.
 - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

1.8 STARTUP CONSTRUCTION SCHEDULE

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction schedule within 30 days of date established for commencement of work.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

1.9 CPM SCHEDULE REQUIREMENTS

- A. Prepare network diagrams using AON (activity-on-node) format.
- B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. CPM Schedule: Prepare Contractor's Construction Schedule using a cost- and resource-loaded, time-scaled CPM network analysis diagram for the Work.
 - 1. Develop network diagram in sufficient time to submit CPM schedule, so it can be accepted for use no later than 60 days after date established for the Notice to Proceed.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates.
 - 2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
 - 3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 - 4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule to coordinate with the Contract Time.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
 - 1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Mobilization and demobilization.
 - c. Purchase of materials.
 - d. Delivery.
 - e. Fabrication.
 - f. Utility interruptions.
 - g. Installation.
 - h. Work by Owner that may affect or be affected by Contractor's activities.
 - i. Testing and inspection.
 - j. Commissioning.
 - k. Punch list and Final Completion.
 - l. Activities occurring following Final Completion.
 - 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.

3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
 - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall Project schedule.
- F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
 1. Contractor or subcontractor and the Work or activity.
 2. Description of activity.
 3. Main events of activity.
 4. Immediate preceding and succeeding activities.
 5. Early and late start dates.
 6. Early and late finish dates.
 7. Activity duration in workdays.
 8. Total float or slack time.
- G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
 1. Identification of activities that have changed.
 2. Changes in early and late start dates.
 3. Changes in early and late finish dates.
 4. Changes in activity durations in workdays.
 5. Changes in the critical path.
 6. Changes in total float or slack time.
 7. Changes in the Contract Time.

1.10 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
 1. List of subcontractors at Project site.
 2. List of separate contractors at Project site.
 3. Approximate count of personnel at Project site.
 4. Equipment at Project site.
 5. Material deliveries.
 6. High and low temperatures and general weather conditions, including presence of rain or snow.
 7. Testing and inspection.

8. Accidents.
 9. Meetings and significant decisions.
 10. Unusual events.
 11. Stoppages, delays, shortages, and losses.
 12. Meter readings and similar recordings.
 13. Emergency procedures.
 14. Orders and requests of authorities having jurisdiction.
 15. Change Orders received and implemented.
 16. Construction Change Directives received and implemented.
 17. Services connected and disconnected.
 18. Equipment or system tests and startups.
 19. Partial completions and occupancies.
 20. Substantial Completions authorized.
- B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:
1. Material stored prior to previous report and remaining in storage.
 2. Material stored prior to previous report and since removed from storage and installed.
 3. Material stored following previous report and remaining in storage.
- C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.
- D. Unusual Event Reports: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.
1. Submit unusual event reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013200

SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Preconstruction photographs.
 - 2. Concealed Work photographs.
 - 3. Periodic construction photographs.
 - 4. Final Completion construction photographs.
 - 5. Preconstruction video recordings.
 - 6. Periodic construction video recordings.
- B. Related Requirements:
 - 1. Section 017700 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.
 - 2. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 INFORMATIONAL SUBMITTALS

- A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph and video recording. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- B. Digital Photographs: Submit image files within three days of taking photographs.
 - 1. Submit photos on CD-ROM or thumb-drive or by uploading to web-based Project management software site. Include copy of key plan indicating each photograph's location and direction.
 - 2. Identification: Provide the following information with each image description in file metadata tag or in web-based Project management software site:
 - a. Name of Project.
 - b. Name and contact information for photographer.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Date photograph was taken.
 - f. Description of location, vantage point, and direction.

- g. Unique sequential identifier keyed to accompanying key plan.
 - C. Video Recordings: Submit video recordings within seven days of recording.
 - 1. Submit video recordings on CD-ROM or thumb drive or by uploading to web-based Project management software site. Include copy of key plan indicating each video's location and direction.
 - 2. Identification: With each submittal, provide the following information in file metadata tag or on web-based Project management software site:
 - a. Name of Project.
 - b. Name and address of photographer.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Date video recording was recorded.
 - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

1.4 FORMATS AND MEDIA

- A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels. Use flash in low light levels or backlit conditions.
- B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full high-definition mode with vibration-reduction technology. Provide supplemental lighting in low light levels or backlit conditions.
- C. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
- D. Metadata: Record accurate date and time from camera.
- E. File Names: Name media files with date and Project area and sequential numbering suffix.

1.5 CONSTRUCTION PHOTOGRAPHS

- A. General: Take photographs with maximum depth of field and in focus.
 - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- B. Preconstruction Photographs: Before commencement of the Work, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
 - 1. Flag excavation areas and construction limits before taking construction photographs.
 - 2. Take photographs to show existing conditions adjacent to property before starting the Work.

3. Take photographs of existing buildings either on or adjoining property, to accurately record physical conditions at start of construction.
 4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- C. Concealed Work Photographs: Before proceeding with installing work that will conceal other work, take photographs sufficient in number, with annotated descriptions, to record nature and location of concealed Work, including, but not limited to, the following:
1. Underground utilities.
 2. Underslab services.
 3. Piping.
 4. Electrical conduit.
 5. Waterproofing and weather-resistant barriers.
- D. Periodic Construction Photographs: Take photographs monthly coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.
- E. Final Completion Construction Photographs: Take photographs after date of Substantial Completion for submission as Project Record Documents. Architect will inform photographer of desired vantage points.
- F. Additional Photographs: Architect may request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.
1. Three days' notice will be given, where feasible.
 2. In emergency situations, take additional photographs within 24 hours of request.
 3. Circumstances that could require additional photographs include, but are not limited to, the following:
 - a. Special events planned at Project site.
 - b. Immediate follow-up when on-site events result in construction damage or losses.
 - c. Photographs shall be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
 - d. Substantial Completion of a major phase or component of the Work.
 - e. Extra record photographs at time of final acceptance.
 - f. Owner's request for special publicity photographs.
 - g. Photographs after an accident or a mishap.

1.6 CONSTRUCTION VIDEO RECORDINGS

- A. Preconstruction Video Recording: Before starting excavation or construction, record video recording of Project site and surrounding properties from different vantage points, as directed by Architect.
1. Flag excavation areas and construction limits before recording construction video recordings.
 2. Show existing conditions adjacent to Project site before starting the Work.

3. Show existing buildings either on or adjoining Project site to accurately record physical conditions at the start of excavation and construction.
 4. Show protection efforts by Contractor.
- B. Periodic Construction Video Recordings: Record video recording monthly coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last video recordings were recorded.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013233

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Submittal schedule requirements.
 - 2. Administrative and procedural requirements for submittals.

- B. Related Requirements:

- 1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
 - 2. Section 013100 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
 - 3. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
 - 4. Section 013233 "Photographic Documentation" for submitting preconstruction photographs, periodic construction photographs, and Final Completion construction photographs.
 - 5. Section 014000 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
 - 6. Section 017700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
 - 7. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 8. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 9. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with

requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.4 SUBMITTAL SCHEDULE

- A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
 2. Initial Submittal Schedule: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
 3. Include Specification number in title of each Submittal.
 4. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.
 5. Include Owner provided, contractor installed items withing submittal schedule.
 - a. For each owner provided item, include a recommended date of purchase for owner review.
 6. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal Category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Architect's final release or approval.
 - g. Scheduled dates for purchasing.
 - h. Scheduled date of fabrication.
 - i. Scheduled dates for installation.
 - j. Activity or event number.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 3. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
 - b. Provide all interior finish submittals, including samples, at one time for Designer and Owner review and selection.
 - c. Provide all exterior finish submittals, including samples, at one time for Designer and Owner review and selection.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 14 calendar days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 14 calendar days for review of each resubmittal.
 4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
 5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.
 6. Allow time for mockup construction, review and approval when allotting time for submittals related to components required in mockups. See Division 01 Section "Quality Requirements" for requirements of mockups. Products required in mockups are indicated in individual Specification Sections.
 - a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.
- D. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section.
 2. Name file with submittal number or other unique identifier, including revision identifier.
 - a. File name shall use and Specification Section number then a sequential number consistently identifying product data shop drawings, samples, etc (e.g., 061000-1.0). Resubmittals shall be identified in the number after the decimal point (e.g., 061000-1.1).
 3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect or Engineer.
 4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software acceptable to Owner, containing the following information:
 - a. Project name.
 - b. Date.

- c. Name and address of Architect.
 - d. Name of Construction Manager.
 - e. Names of subcontractor, manufacturer, and supplier.
 - f. Category and type of submittal.
 - g. Specification Section number and title.
 - h. Drawing number and detail references, as appropriate.
 - i. Location(s) where product is to be installed, as appropriate.
 - j. Related physical samples submitted directly.
 - k. Indication of full or partial submittal.
 - l. Submittal distribution record.
 - m. Other necessary identification.
 - n. Remarks.
- E. Options: Identify options requiring selection by Architect.
- F. Deviations and Additional Information: On an attached separate sheet, prepared on subcontractor's and/or supplier's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
- 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Provide a complete submittal as the resubmittal, including information acceptable in the original submittal or previous resubmittal.
 - 4. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- I. Use for Construction: Retain complete copies of submittals on Project Website. Use only final action submittals that are marked with "No Exception Taken" or "Make Corrections Noted" notation from Architect's action stamp or similar from Engineer's action stamp.
- J. Submittals Log: Prepare, maintain, and distribute a tabular log of submittals organized by the submittal number. Distribute current log at each Monthly Progress Meeting. Provide log with not less than the following information:
- 1. Project name and number, including Owner ID No.
 - 2. Name and address of Architect and GC.
 - 3. Submittal number, including submittals that were returned without action or withdrawn.
 - 4. Submittal description.
 - 5. Submittal category (i.e. Product Data, Show Drawings, Samples, etc).
 - 6. Entity that created the submittal.
 - 7. Date GC received submittal from subcontractor.
 - 8. Date the submittal was sent to the Architect.
 - 9. Date the submittal was returned to the GC.
 - 10. Date returned submittal was forwarded to the subcontractor.

11. Action stamped on submittal by Architect, Engineer or Owner.
 12. Entity that reviewed the submittal (i.e. Architect, Engineer, Owner, etc).
- K. On receipt of returned submittal, update the Submittal Log and immediately distribute the submittal to affected parties.

1.6 SUBMITTAL PROCEDURES

- A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
1. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project management software website. Enter required data in web-based software site to fully identify submittal.
 2. Submit Physical Product Samples directly to Architect's office for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

1.7 SUBMITTAL REQUIREMENTS

- A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.

- c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 - 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams that show factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 - 5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.
- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data unless submittal based on Architect's digital data drawing files is otherwise permitted.
- 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 - 2. Submit shop drawings in the following format:
 - a. PDF electronic file posted to Project Website.
- C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.
- 1. Transmit Samples that contain multiple, related components, such as accessories together in one submittal package.
 - 2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
 - a. Project name and submittal number.
 - b. Generic description of Sample.
 - c. Product name and name of manufacturer.
 - d. Sample source.
 - e. Number and title of applicable Specification Section.
 - f. Specification paragraph number and generic name of each item.

3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics and identification information for record.
 4. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
 5. Paper Transmittal: Include paper transmittal, including complete submittal information indicated.
 6. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 7. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units, showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
 8. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit 5 sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record Sample.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 2. Manufacturer and product name, and model number if applicable.

3. Number and name of room or space.
 4. Location within room or space.
- E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.
- G. Certificates:
1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
 2. Installer Certificates: Submit written statements on manufacturer's letterhead, certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
 3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
 4. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
 5. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
 6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.
- H. Test and Research Reports:
1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
 2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
 3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
 4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
 5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on

evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - a. Name of evaluation organization.
 - b. Date of evaluation.
 - c. Time period when report is in effect.
 - d. Product and manufacturers' names.
 - e. Description of product.
 - f. Test procedures and results.
 - g. Limitations of use.

1.8 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.9 CONTRACTOR'S REVIEW

- A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp or indication in web-based Project management software. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
 1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.10 ARCHITECT'S REVIEW

- A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return.
 - 1. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action.
 - 2. Paper Submittals: Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
 - 3. Submittals by Web-Based Project Management Software: Architect will indicate, on Project management software website, the appropriate action.
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Architect will return without review submittals received from sources other than Contractor.
- F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.3 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.
 - 1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).
- D. Mockups: Physical assemblies of portions of the Work constructed to establish the standard by which the Work will be judged. Mockups are not Samples.

1. Mockups are used for one or more of the following:
 - a. Verify selections made under Sample submittals.
 - b. Demonstrate aesthetic effects.
 - c. Demonstrate the qualities of products and workmanship.
 - d. Demonstrate successful installation of interfaces between components and systems.
 - e. Perform preconstruction testing to determine system performance.
 2. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
 3. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.
 4. Integrated Exterior Mockups: Mockup of the exterior envelope erected separately from the building but on project site, consisting of multiple products, assemblies, and subassemblies.
- E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.
- F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- G. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" has the same meaning as the term "testing agency."
- I. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work, to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- J. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work, to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect.
- 1.4 DELEGATED DESIGN SERVICES
- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated Design Services Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.5 CONFLICTING REQUIREMENTS

- A. Reference Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified is the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.6 ACTION SUBMITTALS

- A. Mockup Shop Drawings:
 1. Include plans, sections, elevations, and details, indicating materials and size of mockup construction.
 2. Indicate manufacturer and model number of individual components.
 3. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.7 INFORMATIONAL SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Qualification Data: For Contractor's quality-control personnel.
- C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:
 1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
 2. Primary wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.

- D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Entity responsible for performing tests and inspections.
 - 3. Description of test and inspection.
 - 4. Identification of applicable standards.
 - 5. Identification of test and inspection methods.
 - 6. Number of tests and inspections required.
 - 7. Time schedule or time span for tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.
- F. Reports: Prepare and submit certified written reports and documents as specified.
- G. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.8 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities and to coordinate Owner's quality-assurance and quality-control activities. Coordinate with Contractor's Construction Schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
 - 1. Project quality-control manager may also serve as Project superintendent.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
 - 1. Contractor-performed tests and inspections, including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.

2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
 3. Owner-performed tests and inspections indicated in the Contract Documents.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring the Work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. Monitoring and Documentation: Maintain testing and inspection reports, including log of approved and rejected results. Include Work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming Work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.9 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
1. Date of issue.
 2. Project title and number.
 3. Name, address, telephone number, and email address of testing agency.
 4. Dates and locations of samples and tests or inspections.
 5. Names of individuals making tests and inspections.
 6. Description of the Work and test and inspection method.
 7. Identification of product and Specification Section.
 8. Complete test or inspection data.
 9. Test and inspection results and an interpretation of test results.
 10. Record of temperature and weather conditions at time of sample-taking and testing and inspection.
 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, telephone number, and email address of technical representative making report.
 2. Statement on condition of substrates and their acceptability for installation of product.
 3. Statement that products at Project site comply with requirements.
 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 6. Statement of whether conditions, products, and installation will affect warranty.
 7. Other required items indicated in individual Specification Sections.

- C. **Factory-Authorized Service Representative's Reports:** Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
 - 1. Name, address, telephone number, and email address of factory-authorized service representative making report.
 - 2. Statement that equipment complies with requirements.
 - 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - 4. Statement of whether conditions, products, and installation will affect warranty.
 - 5. Other required items indicated in individual Specification Sections.

1.10 QUALITY ASSURANCE

- A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. **Manufacturer Qualifications:** A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.
- C. **Fabricator Qualifications:** A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. **Installer Qualifications:** A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. **Professional Engineer Qualifications:** A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
- F. **Specialists:** Certain Specification Sections require that specific construction activities be performed by entities who are recognized experts in those operations. Specialists will satisfy qualification requirements indicated and engage in the activities indicated.
 - 1. Requirements of authorities having jurisdiction supersede requirements for specialists.
- G. **Testing and Inspecting Agency Qualifications:** An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following Contractor's responsibilities, including the following:
 - 1. Provide test specimens representative of proposed products and construction.
 - 2. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - 3. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - 4. Build site-assembled test assemblies and mockups, using installers who will perform same tasks for Project.
 - 5. When testing is complete, remove test specimens and test assemblies, and mockups; do not reuse products on Project.
 - 6. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
- K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups of size indicated or, if not indicated, as approved by Architect.
 - 2. Build mockups in location indicated or, if not indicated, as approved by Architect.
 - 3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 - 4. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
 - 5. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 6. Obtain Architect's approval of mockups before starting corresponding Work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 - 7. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
 - 8. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 9. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

10. Demolish and remove mockups when directed unless otherwise indicated.

- L. Integrated Exterior Mockups: Construct integrated exterior mockup according to reviewed Shop Drawings and as indicated on Drawings. Coordinate Installation of exterior envelope materials and products to be integrated into Exterior Mockup as required in individual Specification Sections, along with supporting materials.
1. Locate mockup as directed by Architect.
 2. See Drawings for mockup details
 3. Build mockups for typical exterior walls, including face veneer masonry and composite metal wall panels, backup wall construction, rigid insulation, air barrier, veneer anchors, flashing and weep holes, sealant, coping, drip edge, and glazed openings. Include metal deck and metal fabrications for support angles and channels.
 - a. After mockup of air barrier and flashing for opening are inspected and approved, install glazed aluminum curtainwall mockup within a portion of masonry opening, as indicated, for review.
 - b. Include sealant for curtainwall intersection with masonry.
 - c. Include sealant for masonry control joint.
 - d. Include 12" CMU, 2 colors of modular brick, and 2 colors of mortar.
 - e. Include 2 colors of composite metal wall panel.
 - f. Include wood blocking.
 4. Clean exposed faces of mockups with masonry cleaner as indicated.
 5. Notify Architect seven days in advance of dates and times when mockups will be constructed. After Architect's review make repairs and corrections to mock-ups as directed by Architect.
 6. Protect accepted mockups from the elements with weather-resistant membrane. Maintain protected mockups during construction in an undisturbed condition as a standard for judging the completed work.
 7. Approval of mockups is for color, texture, blending of masonry units and relationship of mortar and sealant colors to masonry unit colors, tooling of joints and aesthetics qualities of masonry workmanship. Approval of mockups is also for other materials and construction qualities specifically approved by Architect in writing.
 8. Demolish and remove mockups when directed.

1.11 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
 2. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
1. It is the contractor's responsibility to contact the owners testing agency for all required tests. The contractor shall contact the testing agency at the times and interval as set forth

- in this Project Manual and initiate the required tests with sufficient advance notice to allow the testing agency to schedule the inspections.
2. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 3. Engage a qualified testing agency to perform quality-control services.
 - a. Contractor will not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 4. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
 5. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 6. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 7. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- D. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
 3. Conduct and interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from requirements.
 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 6. Do not perform duties of Contractor.
- E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."
- F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

- G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspection equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's Construction Schedule. Update and submit with each Application for Payment.
1. Schedule Contents: Include tests, inspections, and quality-control services, including Contractor- and Owner-retained services, commissioning activities, and other Project-required services paid for by other entities.
 2. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.12 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Owner will engage a qualified testing agency or special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures, and reviewing the completeness and adequacy of those procedures to perform the Work.
 2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
 4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 5. Interpreting tests and inspections, and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.

6. Retesting and reinspecting corrected Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 1. Date test or inspection was conducted.
 2. Description of the Work tested or inspected.
 3. Date test or inspection results were transmitted to Architect.
 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's and authorities' having jurisdiction reference during normal working hours.
 1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspection, sample-taking, and similar services, repair damaged construction and restore substrates and finishes.
 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

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SECTION 014100 - SPECIAL INSPECTION SERVICES**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for Special Inspection services.
- B. Certain structural components of the Project will be subject to the requirements for Special Inspections. Special Inspections will be applicable to the following specification sections:
 - 1. Section 033000 Building Cast-In-Place Concrete
 - 2. Section 042000 Unit Masonry
 - 3. Section 051200 Structural Steel Framing
 - 4. Section 052100 Steel Joist Framing
 - 5. Section 053100 Steel Decking
 - 6. Section 054000 Cold-Formed Metal Framing
 - 7. Section 312000 Earth Moving
- C. The Owner will procure and bear all costs of the Special Inspector and the Independent Testing Laboratory, except as otherwise noted. The Special Inspector will be the manager of the Special Inspection process. The Special Inspector checks the certification of all other inspecting agents required by Special Inspections and coordinates their activities. The Special Inspector carries the responsibility for coordinating Special Inspections. The Statement of Special Inspections will be required by the Building Official as a condition for building permit issuance.
- D. Requirements for Special Inspections are outlined in the Statement and Schedule of Special Inspections included at the end of this section.
 - 1. Specific quality-assurance and control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

- E. Special Inspections are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.
- F. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 1 Section "Quality Control" specifies requirements for repair and restoration of construction disturbed by inspection and testing activities.

1.3 RESPONSIBILITIES

- A. Contractor Responsibilities: Contractor shall provide and include in the Contract Sum, inspections, tests, and other similar quality-control services specified elsewhere in the Contract Documents and required by authorities having jurisdiction except where they are specifically indicated to be the Owner's responsibility, or are provided by another identified entity.
 - 1. Retesting: The Contractor is responsible for retesting where results of inspections, tests, or other quality-control services prove unsatisfactory and indicate noncompliance with Contract Document requirements, regardless of whether the original test was Contractor's responsibility.
 - a. The Contractor shall correct deficiencies in work that inspections and laboratory test reports have indicated to be not in compliance with requirements.
 - b. The cost of retesting and reinspection construction, revised or replaced by the Contractor, is the Contractor's responsibility where required tests performed on original construction indicated noncompliance with Contract Document requirements.
 - 2. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - a. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Associated Services: The Contractor shall cooperate with agencies performing required inspections, tests, and similar services, and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to, the following:
 - a. Provide access to the Work.
 - b. Furnish incidental labor and facilities necessary to facilitate inspections and tests.
 - c. Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.
 - d. Provide and maintain for the sole use of the Special Inspector or Inspectors adequate facilities for safe storage and proper curing of test samples on the Project Site.

- e. Provide the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
- f. Provide security and protection of samples and test equipment at the Project Site.
- g. The Contractor shall designate a representative (the superintendent or an assistant to the superintendent) who shall be the direct point-of-contact with the Special Inspector during each phase of the work. Discrepancies noted during the progress of the work will be reported to the Contractor's representative for corrective action. Communications given by the Special Inspector to the Contractor's representative shall be as binding as if given to the Contractor.

B. Special Inspector Responsibilities:

- 1. The Special Inspector shall coordinate and/or conduct and interpret tests, state in each report whether test specimens comply with requirements, specifically state any deviations therefrom, and record work required and performed to correct deficiencies.
- 2. The Special Inspector will keep records of all inspection and tests which will be furnished to the Building Official, the Architect, and the Structural Engineer of Record.
- 3. The Special Inspector shall notify the Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services. All discrepancies will be brought to the immediate attention of the Contractor for correction. If discrepancies are not corrected, the discrepancies will be brought to the attention of the Owner, Building Official, Architect and the Structural Engineer of Record.
- 4. A final report documenting completion of all required special inspections and corrections of any discrepancies noted will be submitted to the Building Official by the Special Inspector prior to, and as a condition of, issuance of the *Certificate of Use and Occupancy*.
- 5. The Special Inspector shall not perform any duties of the Contractor.
- 6. The Special Inspector shall not release, revoke, alter, decrease or increase the Contract Document requirements.

C. Independent Testing Laboratory Responsibilities: The Independent Testing Laboratory engaged to perform inspections, sampling, and testing of materials and construction specified in individual Sections shall cooperate with the Architect and the Contractor in performance of the Laboratory's duties. The Laboratory shall provide qualified personnel to perform required inspections and tests.

- 1. Notify Architect, Structural Engineer, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
- 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
- 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
- 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
- 5. Shall not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.

D. Coordination: The Contractor and each agency engaged to perform inspection, tests and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. In addition the Contractor and each agency shall coordinate activities to

avoid the necessity of removing and replacing construction to accommodate inspections and tests.

1. The Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities.

1.4 SUBMITTALS

- A. Within 48 hours of each inspection or test, the Special Inspector and the Independent Testing Laboratory shall submit a certified written report, in duplicate, of each inspection, test, or similar service to the Architect and Structural Engineer.

1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.
2. Report Data: Written reports of each inspection, test, or similar service include, but are not limited to, the following:
 - a. Date of issue.
 - b. Project title and number.
 - c. Name, address, and telephone number of testing agency.
 - d. Dates and locations of samples and tests or inspections.
 - e. Names of individuals making the inspection or test.
 - f. Designation of the Work and test method.
 - g. Identification of product and Specification Section.
 - h. Complete inspection or test data.
 - i. Test results and an interpretation of test results.
 - j. Ambient conditions at the time of sample taking and testing.
 - k. Comments or professional opinion on whether inspected or tested Work complies with Contract Document requirements.
 - l. Name and signature of laboratory inspector.
 - m. Recommendations on retesting.

1.5 QUALITY ASSURANCE

- A. Qualification for Special Inspector: The Special Inspector shall be a Registered Professional Engineer, Licensed in the State of North Carolina, experienced in performing special inspections and shall be approved by the Building Official and the Architect. The credentials of all Inspectors and testing technicians shall be provided if requested.
- B. Qualifications for Independent Testing Laboratory: Engage independent inspection and testing laboratories, that are prequalified as complying with the American Council of Independent Laboratories' "Recommended Requirements for Independent Laboratory Qualification" and that specialize in the types of inspections and tests to be performed.
 1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the state where the Project is located.

2. Each independent Inspection and Testing Agency engaged on the Project shall demonstrate that it has the experience and capability to conduct the required field and laboratory testing without delaying the progress of the work. The minimum requirements shall be as follows:
 - a. Reinforced Concrete testing
 - 1) **ACI-CFTT** Concrete Field Testing Technician – Grade 1
 - 2) **ACI-LTT** Laboratory Testing Technician – Grade 1 or 2 and Strength Testing Technician
 - 3) **NICET-CT** – Concrete Technician – Level [I, II, III, IV]
 - b. Reinforced Concrete Inspection
 - 1) **ACI-CCI** Concrete Construction Inspector
 - 2) **ICC-RCSI** Reinforced Concrete Special Inspector
 - c. Structural Steel
 - 1) **AWS-CWI** Certified Welding Inspector
 - 2) **AWS/AISC-CSI** Certified Steel Inspector
 - 3) **ICC-SWSI** Structural Steel and Welding Inspector
 - d. Non-Destructive Testing – American Society of Non-Destructive.
 - e. Structural Masonry
 - 1) **ICC-SMSI** Structural Masonry Special Inspector
 - f. Spray-Applied Fireproofing
 - 1) **ICC-SFSI** Spray-Applied Fireproofing Special Inspector
 - g. Prestressed Concrete
 - 1) **ICC-PCSI** Prestressed Concrete Special Inspector
 - h. Soils Testing
 - 1) **NICET-ST**- Soils Technician Level III
 - 2) **NICET-GET** – Geotechnical Engineering Technician Level III
 - i. Exterior Insulation and Finish Systems (EIFS)
 - 1) **EDI** – EIFS Third Party Inspector
- B. Pre-Construction Conference – Prior to the start of project construction, the Special Inspector and/or Owner's Project Manager shall conduct a Pre-Construction Conference to discuss the requirements for Special Inspections as well as the Administrative Procedures to be followed during the course of the project. Protocols for notification, documentation, and individual responsibilities shall be reviewed. Attendees shall include, but are not limited to:
 1. Owner
 2. Owner's Project Manager
 3. Owner's Project Inspector
 4. Owner's Independent Testing Agency
 5. Architect
 6. Structural Engineer
 7. Contractor's Project Manager

8. Contractor's Superintendent

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

- A. General: Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes. Comply with Contract Document requirements for Division 1 Section "Cutting and Patching."
- B. Protect construction exposed by or for quality-control service activities, and protect repaired construction.
- C. Repair and protection is Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing, or similar services.

END OF SECTION 014100

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
 - 1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."
- B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities.
- C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities.
- D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations.
- E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.3 USE CHARGES

- A. Installation, removal, and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.
- B. Sewer Service: Pay sewer-service use charges for sewer usage by all entities for construction operations.
- C. Water Service: Pay water-service use charges for water used by all entities for construction operations.
- D. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.

1.4 INFORMATIONAL SUBMITTALS

- A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.
- B. Implementation and Termination Schedule: Within 15 days of date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.
- C. Erosion and Sedimentation Control Plan: Show Compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

- D. Erosion and Sedimentation Control Plan: Show compliance with requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
- E. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.
- F. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
- G. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.
 - 1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
 - 2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
 - 3. Indicate methods to be used to avoid trapping water in finished work.
- H. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Include the following:
 - 1. Locations of dust-control partitions at each phase of work.
 - 2. HVAC system isolation schematic drawing.
 - 3. Location of proposed air-filtration system discharge.
 - 4. Waste-handling procedures.
 - 5. Other dust-control measures.
- I. Noise and Vibration Control Plan: Identify construction activities that may impact the occupancy and use of existing spaces within the building or adjacent existing buildings, whether occupied by others, or occupied by the Owner. Include the following:
 - 1. Methods used to meet the goals and requirements of the Owner.
 - 2. Concrete cutting method(s) to be used.
 - 3. Location of construction devices on the site.
 - 4. Show compliance with the use and maintenance of quieted construction devices for the duration of the Project.
 - 5. Indicate activities that may disturb building occupants and that are planned to be performed during non-standard working hours as coordinated with the Owner.
 - 6. Indicate locations of sensitive areas or other areas requiring special attention as identified by the owner. Indicate means for complying with owner's requirements.

1.5 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in the United States Access Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.6 PROJECT SURVEYING

- A. The CM shall retain an independent professional land surveyor, licensed and in good standing in the state of North Carolina. At a minimum, the surveyor shall perform the following:
 - 1. Stake out the Work and set benchmarks at agreed upon locations for continual project reference.
 - 2. Record all existing underground construction encountered during excavation or demolition.
 - 3. Record all new underground work.
 - 4. Annotate and dimension utility lines, bends, terminations, and devices. Utilize permanent features or benchmarks for location by triangulation and record all said information on redline site plans.
 - 5. Record depth below finish grade of new and existing utilities at ends, bends and terminations, devices and intervals not exceeding 20 lineal feet.
 - 6. Maintain all information on the project as-built documents.
 - 7. Provide electronic data as required to maintain all electronic three- dimension project models.

1.7 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

1.8 PARKING

- A. Parking for Contractor use is restricted to site area of work. No parking on adjacent private or public property properties.
- B. Parking violation fees are not the responsibility of the owner and will not be covered as part of the contract fee.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch-OD line posts and 2-7/8-inch-OD corner and pull posts, with 1-5/8-inch-OD top and bottom rails. Provide concrete or galvanized-steel bases for supporting posts.
 - 1. Install fence full perimeter of work area to prevent unauthorized entry.
- B. Fencing Windscreen Privacy Screen: Polyester fabric scrim with grommets for attachment to chain-link fence, sized to height of fence, in color selected by Architect from manufacturer's standard colors.
- C. Dust control adhesive surface walk-off mats: Provide mats, minimum 36 inches by 60 inches.
- D. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool or rock wool; with maximum flame-spread and smoke developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

- A. Field Offices: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
 - 1. Furniture required for Project-site documents, including file cabinets, plan tables, plan racks, and bookcases.
 - 2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot-square tack and marker boards.
 - 3. Drinking water and private toilet.
 - 4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
 - 5. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
 - 1. Store combustible materials apart from building.
 - 2. Store flammable materials in rated safety cabinets.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - 2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
 - 3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 017700 "Closeout Procedures."
 - 4. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.
 - 5. Product Identification Sign: Fixed sign constructed of wood products treated to prevent damage from moisture and insect infestation. Sign to be six feet wide by eight feet high, mounted on solid wood posts embedded into the ground for a rigid, semi-permanent installation with bottom of sign panel mounted 18 inches above grade. All sign components to be smooth, primed and painted white. Provide and install full size multi-color vinyl graphics on one side of sign. Graphics to be printed by professional signage graphics company utilizing image as provided by Architect. Install sign in location as directed by owner.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

- A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
 - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

3.2 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
 - 1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.3 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
 - 1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
 - 1. Use of Permanent Toilets: Use of Owner's existing or new toilet facilities is not permitted.
- E. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
 - 1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.
- F. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
- G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- H. Telephone Service:
 - 1. Provide superintendent with cellular telephone or portable two-way radio.
 - 2. Post a list of important telephone numbers.
 - a. Police and fire departments.
 - b. Ambulance service.
 - c. Contractor's home office.
 - d. Contractor's emergency after-hours telephone number.
 - e. Architect's office.

- f. Engineers' offices.
 - g. Owner's office.
 - h. Principal subcontractors' field and home offices.
- I. Electronic Communication Service: Provide secure WiFi wireless connection to internet with provisions for access by Architect and Owner.
- J. Project Computer: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications. Equip computer with all-in-one printer/copier/scanner and internet service.
- K. WIFI Access: Provide password-protected wireless internet data connection in the primary field office for use by Architect and Owner to access project electronic documents and maintain electronic communications.

3.4 SUPPORT FACILITIES INSTALLATION

- A. Comply with the following:
 - 1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible in accordance with ASTM E136. Comply with NFPA 241.
 - 2. Utilize designated area within existing building for temporary field offices.
 - 3. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
 - 1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
- C. Temporary Use of Planned Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
 - 1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
 - 2. Prepare subgrade and install subbase and base for temporary roads and paved areas as indicated on the Civil Drawings.
 - 3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
 - 4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course as indicated on the Civil Drawings.

- D. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 - 1. Protect existing site improvements to remain, including curbs, pavement, and utilities.
 - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- E. Parking: Provide temporary parking areas for construction personnel.
- F. Storage and Staging: Provide temporary area for storage and staging needs.
- G. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
 - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
 - 2. Remove snow and ice as required to minimize accumulations.
- H. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
 - 1. Identification Signs: Provide Project identification signs as indicated on Drawings.
 - 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 - 3. Maintain and touch up signs, so they are legible at all times.
- I. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."
- J. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
 - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- K. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.
- L. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
 - 1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
 - 1. Comply with work restrictions specified in Section 011000 "Summary."
- C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings.
 - 1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant-protection zones.
 - 2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
 - 3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
 - 4. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.
- D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals, so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.
- G. Site Enclosure Fence: Prior to commencing earthwork, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.
 - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
 - 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.
- H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.
- I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- J. Temporary Egress: Provide temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide signage directing occupants to temporary egress.

- K. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 - 1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
- L. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
 - 1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
 - 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition in accordance with requirements of authorities having jurisdiction.
 - 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 - 4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign, stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.6 MOISTURE AND MOLD CONTROL

- A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.
- B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
 - 1. Protect porous materials from water damage.
 - 2. Protect stored and installed material from flowing or standing water.
 - 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 - 4. Remove standing water from decks.
 - 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
 - 1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 - 2. Keep interior spaces reasonably clean and protected from water damage.
 - 3. Periodically collect and remove waste containing cellulose or other organic matter.
 - 4. Discard or replace water-damaged material.
 - 5. Do not install material that is wet.
 - 6. Discard and replace stored or installed material that begins to grow mold.
 - 7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.

- D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
 - a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective and require replacing.
 - b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
 - c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.7 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.

3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 012500 "Substitution Procedures" for requests for substitutions.
 - 2. Section 01770 "Closeout Procedures" for submitting warranties.

1.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
 - 3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
 - 4. Equal Product: Product that is demonstrated to have the indicated qualities related to type, function, dimension, in service performance, physical properties, appearance and other characteristics that satisfy all the specified requirements of a single product specified with an "or approved equal" clause. Acceptance of Equal Product is subject to approval of designer or owner.
 - 5. Substitutions: Products that deviate from the named product or system in at least one significant characteristic. Substitutions must satisfy the general design intent, but may

require additional changes or coordination to enable incorporation into the work. Acceptance of Substitutions is subject to the approval of designer or owner.

- B. **Basis-of-Design Product Specification:** A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.
 - 1. **Evaluation of Comparable Products:** In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.
- C. **Subject to Compliance with Requirements:** Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.
- D. **Comparable Product Request Submittal:** An action submittal requesting consideration of a comparable product, including the following information:
 - 1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
 - 2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.
- E. **Basis-of-Design Product Specification Submittal:** An action submittal complying with requirements in Section 013300 "Submittal Procedures."
- F. **Substitution:** Refer to Section 012500 "Substitution Procedures" for definition and limitations on substitutions.
 - 1. A substitution request is a pre or post bid request by the contractor to utilize a different product from that as specified. Post bid requests are limited to a substitution product that can be clearly demonstrated as an added benefit to the owner.
 - 2. The requirements for Substitutions do not apply to specified Contractor options on named products and construction methods.
 - 3. Revisions to contract documents, where requested by Architect on behalf of owner or engineer, are "Changes in the Work", not Substitutions.
 - 4. Requested Substitutions approved during bidding period or resulting from negotiations which have been accepted prior to Contract date, are included as part of the Contract Documents.
 - 5. Contractor's determination of and compliance with governing regulations and orders issued by governing authorities do not constitute Substitutions; and do not constitute a

basis for change in Work, except as provided for in Contract Documents. Otherwise, Contractor's requests for changes in products, materials and methods of construction required by the contract documents are considered substitution requests and are subject to the requirements for substitution requests.

- G. Equal Product Requests: An Equal Product Request is a pre or post bid request by the contractor to utilize a product that the contractor determines satisfies all of the specified requirements of a single product specified with an "or approved equal" clause. The proposed Equal Product shall satisfy all of the requirements set forth in the specifications and require no modification to the design.

1.4 ACTION SUBMITTALS

- A. Pre-Bid Substitution Requests: A pre-bid Substitution Request must be submitted on the provided Substitution Request form, attached at the end of this Section, a minimum of ten (10) calendar days prior to the bid opening. Contractor shall submit the fully completed Substitution Request Form, and all of its required documentation, for consideration of each Substitution Product.
- B. Post-Bid Substitution Requests: A post-bid Substitution Request must be submitted on the provided Substitution Request form, attached at the end of this Section, as soon as possible after bids are received. Contractor shall submit the fully completed Substitution Request Form, and all of its required documentation, for consideration of each Substitution Product.
- C. Substitution Request Form (pre- or post-bid):
 - 1. Utilize form attached at the end of this Section. Complete in full, including all required documentation, prior to submittal to Architect.
 - 2. Fully identify product, equipment, system, fabrication or installation proposed to be replaced by Substitution, including related specification section and drawing number(s), and fully document to show compliance with requirements for Substitutions. Include product data/drawings, description of methods, samples where applicable, Contractor's detailed comparison of significant qualities between specified item and proposed Substitution, statement of effect on construction time and coordination with other affected work, cost information or proposal, and Contractor's statement to the effect that proposed Substitution will result in overall work equal-to-or-better-than work originally indicated.
 - 3. Information that is incomplete will not be considered.
 - 4. Architect's Action:
 - a. Pre-Bid Request: If Substitution Request is approved by Architect or Engineer, approval will be notified by Bid Addendum to all interested bidders. If additional information or documentation is required by Architect after receipt of original Substitution Request, Architect will notify Contractor within three calendar days of request with the need for additional information. However, Substitution Requests, including additional information notifications and receipt, can only be received up to ten calendar days prior to bid opening to allow Architect time to review and incorporate an approvals into a Bid Addendum. If submitted within ten (10)

calendar days prior to the Bid Date, Contractor's request for substitution will be received and considered when extensive revisions to Contract Documents are not required and changes are in keeping with general intent of Contract Documents; when timely, fully documented and properly submitted; and when the following conditions is satisfied, all as judged by Architect. Otherwise, requests will be returned without action except to record non-compliance with these requirements.

- 1) Where substantial advantage is offered Owner, in terms of cost, time or other valuable considerations, after deducting offsetting responsibilities Owner may be required to bear, including additional compensation to Architect/Engineer for redesign and evaluation services, increased cost of other work by Owner or separate contractors, and similar considerations.
- b. Post-Bid Request: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a Substitution Request. Architect will notify Contractor of approval or rejection of proposed Substitution within 15 calendar days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later. Contractor's request for product revision will be received and considered when extensive revisions to Contract Documents are not required and changes are in keeping with general intent of Contract Documents; when timely, fully documented and properly submitted; and when the following conditions are satisfied, all as judged by Architect. Otherwise, requests will be returned without action except to record non-compliance with these requirements.
 - 1) Where substantial advantage is offered Owner, in terms of cost, time or other valuable considerations, after deducting offsetting responsibilities Owner may be required to bear, including additional compensation to Architect/Engineer for redesign and evaluation services, increased cost of other work by Owner or separate contractors, and similar considerations.
 - 2) A Substitution Request will not be received or considered when the request is made by the Contractor in order to procure a product that has a shorter lead time than the specified product, and the Contractor has failed to order the specified product in a timely manner.
- D. Equal Product Requests: An Equal Product Request must be submitted on the provided Equal Product Request form, attached at the end of this Section, as soon as possible after bids are received. Contractor shall submit the fully completed Equal Product Request Form, and all of its required documentation, for consideration of each Equal Product.
- E. Equal Product Request Form:
 1. Utilize form attached at the end of this Section. Complete in full, including all required documentation, prior to submittal to Architect.
 2. Information that is incomplete will not be considered.
 3. Architect's Action:
 - a. If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of an Equal Product Request. Architect will notify Contractor of approval or rejection of proposed Equal Product within 15

calendar days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

- b. Architect will consider Contractor's Equal Product Request when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
 - 1) Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 - 2) Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - 3) Evidence that proposed product provides specified warranty.
 - 4) List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 - 5) Samples, if requested.
 - 6) Will coordinate installation and make changes to other work, which may be required for the Work to be complete with no additional cost to Owner.
 - 7) Waives claims for additional costs or time extension, which may subsequently become apparent.

1.5 QUALITY ASSURANCE

- A. Source Limitations: To the greatest extent possible, provide products, materials and equipment of singular generic kind and from a single source.
- B. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
 - 1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
 - 2. If a dispute arises between contractors over concurrently selectable but incompatible products, the Architect will determine which product shall be used.
 - 3. Compatibility is a basic general requirement of product/material selections.
- C. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.
 - 1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.

2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
 - a. Name of product and manufacturer.
 - b. Model and serial number.
 - c. Capacity.
 - d. Speed.
 - e. Ratings.
3. See individual identification Sections in Divisions 21, 22, 23, and 26 for additional equipment identification requirements.

1.6 COORDINATION

- A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 4. Inspect products on delivery to determine compliance with the Contract Documents and that products are undamaged and properly protected.
- C. Storage:
 1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
 2. Store products to allow for inspection and measurement of quantity or counting of units.
 3. Store materials in a manner that will not endanger Project structure.
 4. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.
 5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.

6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.8 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Architect will make selection.

5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," or "or comparable," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
 - a. Submit additional documentation required by Architect in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by the Architect, whose determination is final.

B. Product Selection Procedures:

1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."
2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."
3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
 - a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."
4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.
 - a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
 - b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.
5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.

- a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."
6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.
 - a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
 - b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.
7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
 - a. For approval of products by unnamed manufacturers, comply with requirements in Section 012500 "Substitution Procedures" for substitutions for convenience.
- C. Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
 1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:
 1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type,

- function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
 - 3. Evidence that proposed product provides specified warranty.
 - 4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
 - 5. Samples, if requested.
- B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 013300 "Submittal Procedures."
- 1. Form of Approval of Submittal: As specified in Section 013300 "Submittal Procedures."
 - 2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- C. Submittal Requirements, Single-Step Process: When acceptable to Architect, incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval by the Architect of Contractor's request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SUBSTITUTION REQUEST

Project:

Owner:

Owner ID No.:

DKA Project No.:

Date:

Contractor:

Submitted by:

Product Name/Item as listed in specification:

Specification section and paragraph:

Description of substitution product:

Name, Model Number, other information as required to enumerate product

Proposed cost impact: Y or N

Describe affect, if any on construction schedule:

Supporting Data:

List attached supporting data including drawings, cut sheets, samples, installation information, etc.

Affected trades:

List other trades that are affected by incorporation of this substitution product

The Undersigned certifies that the proposed substitution/revision:

Has been fully investigated and determined to be equal or superior to the specified product. This includes, but is not limited to, durability, appearance and performance.

Will have the same or better warranty coverage and duration.

Will have the same or better maintenance and service requirements and availability of replacement parts.

Will have no adverse effect on other trades and will not negatively affect or delay progress schedule.

Will not diminish the effectiveness of any rated assembly or in any way affect any quality or function as it relates to code compliance

Does not alter the design intent and/or functional requirements.

Does not require extensive modifications to the design or require extensive coordination.

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The Undersigned certifies that the proposed substitution satisfies all of the requirements set forth in the contract documents and in this request.

Requesting entity:

Submitter representative name:	Company:
Signature:	Telephone:

Architect's Action:

- ☐ Substitution approved as submitted.
- ☐ Substitution approved as noted.
- ☐ Substitution rejected.
- ☐ Substitution request not submitted in proper timeframe – Action on request not permitted

Notes:

DKA representative:	Date:
Signature:	

Attachments: -

EQUAL PRODUCT REQUEST

Project:	
Owner:	
Owner ID No.:	
DKA Project No.:	Date:
Contractor:	Submitted by:

Product Name/Item as listed in specification:	Specification section and paragraph:
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Description of substitution product:

Name, Model Number, other information as required to enumerate product

Proposed cost impact: Y or N	Describe affect, if any on construction schedule:
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Supporting Data:

List attached supporting data including drawings, cut sheets, samples, installation information, etc.

Affected trades:

List other trades that are affected by incorporation of this substitution product

The Undersigned certifies that the proposed substitution/revision:

Has been fully investigated and determined to be equal or superior to the specified product. This includes, but is not limited to, durability, appearance and performance.

Will have the same or better warranty coverage and duration.

Will have the same or better maintenance and service requirements and availability of replacement parts.

Will have no adverse effect on other trades and will not negatively affect or delay progress schedule.

Will not diminish the effectiveness of any rated assembly or in any way affect any quality or function as it relates to code compliance

Does not alter the design intent and/or functional requirements.

Does not require extensive modifications to the design or require extensive coordination.

TOWN OF FARMVILLE | Farmville Fire Station

The Undersigned certifies that the proposed substitution satisfies all of the requirements set forth in the contract documents and in this request.

Requesting entity:

Submitter representative name:	Company:
Signature:	Telephone:

Architect's Action:

- ☐ Substitution approved as submitted.
- ☐ Substitution approved as noted.
- ☐ Substitution rejected.
- ☐ Substitution request not submitted in proper timeframe – Action on request not permitted

Notes:

DKA representative:	Date:
Signature:	

Attachments: -

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.
 - 4. Cutting and patching.
 - 5. Progress cleaning.
 - 6. Starting and adjusting.
 - 7. Protection of installed construction.
 - 8. Correction of the Work.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting surveys.
 - 2. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
 - 3. Section 078413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.4 PREINSTALLATION MEETINGS

- A. Cutting and Patching Conference: Conduct conference at Project site.
 - 1. Prior to commencing work requiring cutting and patching, review extent of cutting and patching anticipated and examine procedures for ensuring satisfactory result from cutting

and patching work. Inform Architect of scheduled meeting. Require representatives of each entity directly concerned with cutting and patching to attend, including the following:

- a. Contractor's superintendent.
 - b. Trade supervisor responsible for cutting operations.
 - c. Trade supervisor(s) responsible for patching of each type of substrate.
 - d. Mechanical, electrical, and utilities subcontractors' supervisors, to the extent each trade is affected by cutting and patching operations.
2. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

B. Layout Conference: Conduct conference at Project site.

1. Prior to establishing layout of new perimeter and structural column grid(s), review building location requirements. Review benchmark, control point, and layout and dimension requirements. Inform Architect of scheduled meeting. Require representatives of each entity directly concerned with Project layout to attend, including the following:
 - a. Contractor's superintendent.
 - b. Professional surveyor or professional engineer responsible for performing Project surveying and layout.
 - c. Professional surveyor or professional engineer responsible for performing site survey serving as basis for Project design.
2. Review meanings and intent of dimensions, notes, terms, graphic symbols, and other layout information indicated on the Drawings.
3. Review requirements for including layouts on Shop Drawings and other submittals.
4. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For land surveyor or professional engineer.
- B. Certified Surveys: Submit two copies signed by land surveyor or professional engineer.
- C. Certificates: Submit certificate signed by land surveyor or professional engineer, certifying that location and elevation of improvements comply with requirements.
- D. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.6 CLOSEOUT SUBMITTALS

- A. Final Property Survey: Submit 3 copies showing the Work performed and record survey data.

1.7 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
- B. Professional Engineer Qualifications: Refer to Section 014000 "Quality Requirements."
- C. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 - 1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
 - 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:
 - a. Primary operational systems and equipment.
 - b. Fire separation assemblies.
 - c. Air or smoke barriers.
 - d. Fire-suppression systems.
 - e. Plumbing piping systems.
 - f. Mechanical systems piping and ducts.
 - g. Control systems.
 - h. Communication systems.
 - i. Fire-detection and -alarm systems.
 - j. Conveying systems.
 - k. Electrical wiring systems.
 - l. Operating systems of special construction.
 - 3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
 - a. Water, moisture, or vapor barriers.
 - b. Membranes and flashings.
 - c. Equipment supports.
 - d. Piping, ductwork, vessels, and equipment.
 - e. Noise- and vibration-control elements and systems.
 - 4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

- D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.
- C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
 - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services; and other utilities.
 - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations and provide written report to Architect.
 - 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 - 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 - 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 - 1. Description of the Work, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.
 - 2. List of detrimental conditions, including substrates.
 - 3. List of unacceptable installation tolerances.
 - 4. Recommended corrections.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect in accordance with requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify Architect promptly.
- B. Engage a land surveyor or professional engineer experienced in laying out the Work, using the following accepted surveying practices:
 - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 - 2. Establish limits on use of Project site.
 - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 4. Inform installers of lines and levels to which they must comply.
 - 5. Check the location, level and plumb, of every major element as the Work progresses.

6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

- A. Identification: Owner will identify existing benchmarks, control points, and property corners.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.
- E. Final Property Survey: Engage a land surveyor or professional engineer to prepare a final property survey showing significant features (real property) for Project. Include on the survey a

certification, signed by land surveyor or professional engineer, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

- A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 1. Make vertical work plumb, and make horizontal work level.
 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces, unless otherwise indicated on Drawings.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure satisfactory results as judged by Architect. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.
- F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.
 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.

2. Allow for building movement, including thermal expansion and contraction.
 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.

3.6 OWNER INSTALLED PRODUCTS

- A. Site Access: Provide access to Project Site for Owner's construction personnel.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
 2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the work that are to receive owner's work. Attend preinstallation conferences conducted by the owner's construction personnel if portions of the work depend on owners consultation.

3.7 OWNER PROVIDED CONTRACTOR INSTALLED PRODUCTS

- A. Site Access: Provide access to Project Site for Owner's construction personnel.
- B. Coordination: Coordinate construction and operations of the Work with delivery and procurement of items purchased by Owner.
1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's purchase and delivery of owner provided items. Adjust construction schedule based on mutually agreed timetable. Notify the owner if changes to the schedule are required due to differences in actual construction progress.
 2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the work that are to receive owner's work. Attend preinstallation conferences conducted by owner construction personnel if portions of work depend on owners' construction.

3.8 CUTTING AND PATCHING

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of Work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - 6. Proceed with patching after construction operations requiring cutting are complete.
- F. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by Architect. Provide materials and comply with installation requirements specified in other Sections, where applicable.
 - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 - 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final

paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- G. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.9 PROGRESS CLEANING

- A. Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
1. Use cleaning products that meet the Green Seal GS 37 standard; floor cleaners complying with CA code of Regulations maximum VOC content; and disposable paper products, supplies and trash bags meeting the minimum requirements of US EPA's Comprehensive Procurement Guidelines. See Division 01 sections "Closeout Procedures" for additional requirements.
 2. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 3. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
 4. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - a. Use containers intended for holding waste materials of type to be stored.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.
 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: To the extent possible through reasonable control and protection methods (including barricade provisions), supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging or otherwise deleterious exposure during the construction period. Such exposures include (where applicable, but not by way of limitation) static loading, dynamic loading, internal pressures, external pressures, high or low temperature, thermal shock, high or low humidity, air contamination or pollution, water, ice, solvents, chemicals, light, radiation, puncture, abrasion, heavy traffic, soiling, bacteria, insect infestation, combustion, electrical current, high speed operation, improper lubrication, unusual wear, misuse, incompatible interface, destructive testing, misalignment, excessive weathering, unprotected storage, improper shipping/handling, theft and vandalism.

3.10 STARTING AND ADJUSTING

- A. Coordinate schedule for start-up of various equipment and systems. Coordinate startup and adjusting of equipment and operating components with requirements in Division 01 Section "General Commissioning Requirements".
- B. Notify Architect and Owner at least three days prior to start-up of each item.
- C. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units and retest.
- D. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- E. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace safeties and malfunctioning controls and equipment.
- F. Verify that each piece of equipment or system has been checked for proper control sequence, and for conditions which may cause damage.
- G. Verify test, meter readings and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- H. Verify that wiring and support components for equipment are complete and tested.

- I. Execute start-up under supervision of applicable Contractor personnel in accordance with manufacturer's instructions.
- J. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- K. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- L. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."
- M. When specified in individual sections, require manufacturer to provide authorized representation to be present on site to inspect, check and approve equipment or system installation prior to start up and to supervise placing equipment or system in operation.
- N. Manufacturer's Field Service: Comply with qualification requirements in Division 01 Section "Quality Requirements".
- O. All documentation required by individual Sections for commissioning, including "Building Enclosure Commissioning", "General Commissioning Requirements", "Commissioning of Plumbing Systems", "Commissioning of HVAC Systems" and "Commissioning of Electrical Systems", shall be completed and submitted to the Commissioning Agent prior to starting up equipment and systems.

3.11 DEMONSTRATION AND INSTRUCTION

- A. As required by individual Sections, demonstrate start up, operation, control, adjustment, trouble shooting, servicing, maintenance, and shutdown of each item of equipment at agreed time, at agreed equipment location.
- B. For equipment or systems requiring seasonal operation, perform demonstrations for other seasons within six months.
- C. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction to owner's personnel.
- D. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with owner's personnel in detail to explain all aspects of operation and maintenance.
- E. Prepare and insert additional data in operation and maintenance manuals when need for additional data becomes apparent during instruction.

3.12 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.13 CORRECTION OF THE WORK

- A. Repair or remove and replace damaged, defective, or nonconforming Work. Restore damaged substrates and finishes.
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.
- C. Restore permanent facilities used during construction to their specified condition.
- D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

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SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Salvaging nonhazardous construction waste.
 - 2. Recycling nonhazardous construction waste.
 - 3. Disposing of nonhazardous construction waste.
- B. Related Requirements:
 - 1. Section 011200 "Multiple Contract Summary" for coordination of responsibilities for waste management.
 - 2. Section 042000 "Unit Masonry" for disposal requirements for masonry waste.
 - 3. Section 044313.13 "Anchored Stone Masonry Veneer" for disposal requirements for excess stone and stone waste.
 - 4. Section 044313.16 "Adhered Stone Masonry Veneer" for disposal requirements for excess stone and stone waste.
 - 5. Section 311000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

- A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner's property.
- C. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- D. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- E. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition and construction waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 7 days of date established for commencement of the Work .

1.6 INFORMATIONAL SUBMITTALS

- A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Use Form CWM-7 for construction waste . Include the following information:
 - 1. Material category.
 - 2. Generation point of waste.
 - 3. Total quantity of waste in tons.
 - 4. Quantity of waste salvaged, both estimated and actual in tons.
 - 5. Quantity of waste recycled, both estimated and actual in tons.
 - 6. Total quantity of waste recovered (salvaged plus recycled) in tons.
 - 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. LEED Submittal: Submit documentation to USGBC, signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met. Respond to questions and requests from USGBC regarding construction waste management and disposal until the USGBC has made its determination on the

Project's LEED certification application. Document correspondence with USGBC as informational submittals.

- H. Qualification Data: For waste management coordinator and refrigerant recovery technician.
- I. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.7 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: Experienced firm, or individual employed and assigned by General Contractor, with a record of successful waste management coordination of projects with similar requirements. Superintendent may serve as Waste Management Coordinator.
 - 1. Firm employs a LEED-Accredited Professional, certified by the USGBC, as waste management coordinator.
 - 2. Waste management coordinator may also serve as LEED coordinator.
- B. Regulatory Requirements: Comply with transportation and disposal regulations of authorities having jurisdiction.
- C. Waste Management Conference(s): Conduct conference(s) at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
 - 1. Review and discuss waste management plan including responsibilities of each contractor and waste management coordinator.
 - 2. Review requirements for documenting quantities of each type of waste and its disposition.
 - 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 - 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 - 5. Review waste management requirements for each trade.

1.8 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of site-clearing and construction waste generated by the Work. Use Form CWM-1 for construction waste . Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Use Form CWM-3 for construction waste . Include points

of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
 2. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
 3. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 4. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
 5. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.
- D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there were no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Use Form CWM-5 for construction waste . Include the following:
1. Total quantity of waste.
 2. Estimated cost of disposal (cost per unit). Include transportation and tipping fees and cost of collection containers and handling for each type of waste.
 3. Total cost of disposal (with no waste management).
 4. Revenue from salvaged materials.
 5. Revenue from recycled materials.
 6. Savings in transportation and tipping fees by donating materials.
 7. Savings in transportation and tipping fees that are avoided.
 8. Handling and transportation costs. Include cost of collection containers for each type of waste.
 9. Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total nonhazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials , including the following:
1. Construction Waste:
 - a. Masonry and CMU.
 - b. Lumber.
 - c. Wood sheet materials.
 - d. Wood trim.
 - e. Metals.
 - f. Roofing.
 - g. Insulation.

- h. Carpet and pad.
- i. Gypsum board.
- j. Piping.
- k. Electrical conduit.
- l. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
 - 1) Paper.
 - 2) Cardboard.
 - 3) Boxes.
 - 4) Plastic sheet and film.
 - 5) Polystyrene packaging.
 - 6) Wood crates.
 - 7) Wood pallets.
 - 8) Plastic pails.
- m. Construction Office Waste: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following construction office waste materials:
 - 1) Paper.
 - 2) Aluminum cans.
 - 3) Glass containers.

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
 - 1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
 - 1. Distribute waste management plan to everyone concerned within three days of submittal return.
 - 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged and recycled.

2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.
- E. Waste Management in Historic Zones or Areas: Transportation equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, by 12 inches or more.

3.2 RECYCLING AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor .
- C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
- D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
 1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.
 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 4. Store components off the ground and protect from the weather.
 5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor as often as required to prevent overfilling bins.

3.3 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 2. Polystyrene Packaging: Separate and bag materials.
 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
 - a. Comply with requirements in Section 329300 "Plants" for use of clean sawdust as organic mulch.
- C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.
 - a. Comply with requirements in Section 329300 "Plants" for use of clean ground gypsum board as inorganic soil amendment.
- D. Paint: Seal containers and store by type.

3.4 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged or recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.

3.5 ATTACHMENTS

- A. Form CWM-1 for construction waste identification.
- B. Form CWM-3 for construction waste reduction work plan.
- C. Form CWM-5 for cost/revenue analysis of construction waste reduction work plan.
- D. Form CWM-7 for construction waste reduction progress report.

END OF SECTION 017419

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SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
- B. Related Requirements:
 - 1. Section 012900 "Payment Procedures" for requirements for Applications for Payment for Substantial Completion and Final Completion.
 - 2. Section 013233 "Photographic Documentation" for submitting Final Completion construction photographic documentation.
 - 3. Section 017823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
 - 4. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
 - 5. Section 017900 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.3 DEFINITIONS

- A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of cleaning agent.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.5 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest-control inspection.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items required by other Sections.

1.7 PRE-FINAL INSPECTOIN

- A. Preliminary Procedures: Before requesting inspection for determining date of Final Acceptance, complete the following:
 - 1. Prepare a detailed, comprehensive list of items of Work, areas of Work or other description of portion of Work not complete. Include the value of items on the list, and reasons why the Work is not complete. (Contractor's List of Incomplete Work)
 - 2. Prepare a detailed, comprehensive list of items to be corrected (punch list) including the value of items on the list. (Contractor's Punchlist)
 - 3. Advise Owner of pending insurance changeover requirements.
 - 4. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 5. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 6. Prepare and submit As-Built Documents in PDF format for Owner's use, including As-Built (Redline) Drawings, As-Built (Redline) Project Manual, Project Record Documents, operation and maintenance manuals, final completion construction photographs, damage or settlement surveys, property surveys and similar final record information.
 - 7. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
 - a. Schedule of Maintenance Material Items: Prepare and submit a final schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Owner's signature for receipt of submittals.
 - 8. Coordinate final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 9. Complete startup testing of systems.
 - 10. Submit test/adjust/balance records.
 - 11. Perform preventive maintenance on equipment used prior to Pre-Final Inspection.
 - 12. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements that will not be reused in future phases and that must be removed for ongoing site operation by the Owner.
 - 13. Advise Owner of changeover in heat and other utilities.

14. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
15. Complete final cleaning requirements, including touchup painting.
16. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Pre-Final Inspection: Submit a written request for Pre-Final Inspection. On receipt of request, Architect will either schedule and conduct the Pre-Final Inspection with the approval of the State Construction Office or notify Contractor of unfulfilled requirements. Architect will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before request for Final Inspection will be made.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Acceptance.

1.8 INSPECTIONS

A. Architect and his design consultants will conduct a Pre-Final and Final Inspection prior to the Owner's Final Acceptance of the Work. A complete and thorough training shall be conducted by the subcontractors to instruct the Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems after the Pre-Final Inspection. See Owner's training requirements elsewhere in the Documents.

1. The Pre-Final Inspection shall be held after all systems are in place and in operation. All major subcontractors shall demonstrate to the Architect that all systems in the building are properly installed, balanced, and performing as designed and specified. All major subcontractors shall attend this inspection.
2. The Final Inspection shall be held with the Owner, Architect, Contractor and Subcontractors to demonstrate to the Owner that all systems in the building are operating as designed and to their satisfaction. The final HVAC inspection results shall be certified by design professionals.

1.9 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:

1. Submit a final Application for Payment in accordance with Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.
5. Submit Final Completion photographic documentation.

- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
 - 1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 - 2. Designers will perform reinspection. If work is found to remain incomplete or not repaired the cost of any subsequent reinspection will be deducted from the Contract Sum due to the contractor.

1.10 LIST OF INCOMPLETE ITEMS

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
 - 1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor, listed by room or space number.
 - 2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
 - 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.
 - 4. Submit list of incomplete items in one of the following formats:
 - a. MS Excel Electronic File: Architect will return annotated file.
 - b. PDF Electronic File: Architect will return annotated file.
 - c. Web-Based Project Software Upload: Utilize software feature for creating and updating list of incomplete items (punch list).

1.11 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Special Warranties: When the Contract Documents require the Contractor, or the Contractor and a subcontractor, supplier, or manufacturer to execute a special warranty, prepare a written document that contains appropriate terms and identification, ready for execution by the required

parties. Submit a draft to the Owner, through the Architect, for approval prior to the final execution.

- C. Refer to Divisions 02 through 33 Sections for specific content requirements and particular requirements for submitting special warranties.
- D. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- E. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
 - 1. Submit on digital media acceptable to Architect, by uploading to web-based project software site, or by email to Architect.
- F. Warranties in Paper Form:
 - 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
 - 4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- G. Provide additional copies of each warranty to include in operation and maintenance manuals.

1.12 AS-BUILT DRAWINGS & DOCUMENTATION

- A. Maintain a white-print set (black-line) of contract drawings and shop drawings in clean, undamaged condition, with mark-up of actual installations which vary substantially from the work as originally shown. The Contractor shall record all changes from the Contract Drawings, including accurate dimensions where applicable including invert elevations for all below-grade outside utilities with reference to permanent above-grade objects.
 - 1. Do not use the as-built set for any other construction related activities. Do not 'break up' the set into individual drawings or portions.
 - 2. Mark whichever drawing is most capable of showing "field" condition fully and accurately. Where shop drawings are used for mark-up, record a cross-reference at corresponding location on working drawings. Mark with permanent red ink and, where required for clarity, use other colors to distinguish between variations in separate categories of work. Give particular attention to concealed work, which would be difficult to measure and record at a later date.
 - 3. Organize as-built drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on cover of each set.

- Submit to Architect as "As Built Drawings" for Owner's records, so that Architect may prepare a set of reproducible record drawings for Owner's use.
4. Record and submit any revised specifications resulting from substitutions or Contractor requested changes.
 5. The 'As-Built' submittal will consist of the following items in the following formats:
 - a. Neatly drafted complete set of "redline" drawings to Designer, scanned and paper copies.
 - b. Neatly annotated complete set of "redline" project specifications to Designer, scanned and paper copies.
 - c. One (1) copy of complete set of "redline" drawings and specifications scanned in PDF format to WTCC.
- B. Camera and record all waste plumbing lines, 3-inches or larger to first manhole outside building, after construction is complete.
1. Submit one copy of electronic video to Owner with clear documentation of where video footage was taken at each separate waste plumbing line.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

2.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting Pre-Final Inspection.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.

4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program and appropriate for that room's use. Comply with manufacturer's written instructions.
 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, yard, and grounds, areas disturbed by construction activities, including landscape development areas and parking lots, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Clean flooring, removing debris, dirt, and staining; clean according to manufacturer's recommendations.
 - i. Vacuum and mop concrete.
 - j. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - l. Remove labels and transparent covers that are not permanent.
 - m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

- n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - p. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - q. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
 - r. Clean strainers.
 - s. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with waste-disposal requirements in Section 015000 "Temporary Facilities and Controls."

END OF SECTION 017700

SECTION 017740 – WARRANTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for warranties required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.

- 1. Refer to the General Conditions for terms of the Contractor's period for correction of Work.

1.3 RELATED SECTIONS

- A. Division 01 Section "Closeout Procedures" for procedures related to submitting warranties.
- B. Division 01 Section "Roof Warranties" for warranties specific to roofing systems.
- C. Divisions 02 through 33 Sections for specific requirements for continuing services to the Owner.
- D. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.4 DEFINITIONS

- A. Standard product warranties are preprinted written warranties published by the individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
- B. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.5 WARRANTY REQUIREMENTS

- A. Related damage and losses: When correcting failed or damaged warranted construction, remove and replace Work that has been damaged as a result of such failure, or must be removed and replaced to provide access for correction of warranted construction.

- B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or reworking, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- C. Replacement cost: Upon determination that Work covered by a warranty has failed, replace or rework the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or reworking defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.
- D. Owner's recourse: Expressed warranties made to the Owner are in an addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.
- E. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
- F. Where the Contract Documents require a special warranty or similar commitment on the Work or part of the Work, the Owner reserves the right to refuse to accept the Work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

1.6 SUBMITTALS

- A. See Division 01 Section "Closeout Procedures" for warranty submittal requirements.

PART 2 - PRODUCTS

(NOT APPLICABLE)

PART 3 - EXECUTION

(NOT APPLICABLE)

END OF SECTION 017740

SECTION 017750 – ROOF WARRANTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. This Section includes administrative and procedural requirements for Roof Warranties.

- B. Related Requirements:

- 1. Division 01 Section “Alternates”
 - 2. Division 01 Section “Warranties”.
 - 3. Division 06 Section “Rough Carpentry”.
 - 4. Division 07 Section “Sheet Metal Flashing and Trim”.
 - 5. Division 07 Section “Joint Sealants”.

1.3 CLOSEOUT SUBMITTALS

- A. Upon completion of the work and prior to the final payment the Contractor shall submit the following items to the Designer. All such documents shall show the project name and location and the Owner's name:

- 1. Documentation of completion of all items noted on roof punch lists prepared by the Designer.
 - 2. Statement from the roofing system manufacturer that all bills have been paid.
 - 3. Three copies of Contractor’s Roofing System Guarantee to Owner for each roofing system type.
 - 4. Three copies of Roof System Manufacturer’s Guarantee to Owner for each roofing system type.

- B. The effective date of all warranties shall be the same and shall be on the date of the last final inspection when the Owner, Designer, Contractor and Manufacturer agree that all work has been completed in substantial compliance with the plans and specifications. This date shall be the date of Final Acceptance by the Owner.

- C. Final payment will additionally be subject to other specified requirements of the Contract Documents, including requirements specified in the General Conditions of the Contract.

1.4 SPECIAL WARRANTIES

- A. General:

1. All guarantees shall be issued to the Owner or party designated by the Designer and shall not require the signature of the Owner.
2. All guarantees shall be issued bearing the signature of an Officer of the Manufacturer or Contractor as applicable.
3. All guarantees shall commence on the date of Final Acceptance by the Owner and shall be in force for the durations as noted below.
4. All guarantees shall cover damage due to wind up to and including the design wind speed as defined by the North Carolina State Building Code.
5. All guarantees shall not include any language stipulating resolution of disputes through arbitration.
6. All guarantees shall not include any language excluding coverage for any of the following:
 - a. Failure of the roofing contractor to properly install the roof system or to use properly certified personnel.
 - b. Failure of the roofing contractor to utilize manufacturer approved materials or methods.
 - c. Requirements for the owner to maintain records of material procurement including but not limited to purchase orders, order numbers, manufacturer's invoices or shipment dates.
 - d. Failure of the roofing contractor to correct any deficiencies identified by the manufacturer.
7. In the event of a claim against the warranty, the manufacturer shall be responsible for all costs related to the investigation of said claim.
8. Warranty Period for Asphalt Shingle Roofs: NDL warranty for 25 years from date of Final Acceptance.
9. Warranty Period for Metal Roofs: NDL warranty for 25 years from date of Final Acceptance.

B. Contractor's Guarantee:

1. Duration - Two (2) years from date of Final Acceptance by the Owner.
2. The Contractor and the Owner's representative shall conduct an inspection approximately 30 days prior to the end of the Contractor's guarantee to determine the present physical condition of the roofing system. The Owner's representative shall then submit a written report as to the findings of this inspection and the roofing Contractor, at his own expense, shall repair any defects covered under the scope of this Contract.
3. The Contractor's Guarantee shall neither replace nor negate any agreement furnished by the manufacturers.

- C. Sealant Manufacturer's Warranty – Manufacturer shall agree that all exterior joint sealant used in roofing, and roofing flashing and trim work shall remain free from any physical defects caused by defective workmanship or materials for a period of ten (10) years from date of Final Acceptance.
- D. Flashing and Trim Sheet Metal Manufacturer's Finish Warranty – The sheet metal manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: Twenty (20) years from date of Final Acceptance.

1.5 EMERGENCY REPAIRS

- A. Emergency repairs to defects and leaks shall be performed within 24 hours of receiving notice from the Owner. As soon as weather permits, permanent repairs and restoration of affected areas shall be accomplished in a manner in conformance with the original contract requirements. This work shall be done without additional cost to the Owner, except if it is determined that such leaks and defects were caused by abuse, lightning, hurricane, tornado, hail storm, or other unusual phenomena.
- B. The warranties shall also state that the Owner has the right, at any time during the Contractor's warranty period and the Manufacturer's warranty period, to make emergency repairs to protect the contents of the building or the building itself from damage due to leaking. The cost of emergency repairs made during the first two years of the warranty period shall be borne by the Contractor and action by the Owner shall not invalidate the warranty.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 017750

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SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory manuals.
 - 2. Emergency manuals.
 - 3. Systems and equipment operation manuals.
 - 4. Systems and equipment maintenance manuals.
 - 5. Product maintenance manuals.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect will comment on whether content of operation and maintenance submittals is acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operation and maintenance manuals in one of the following formats as acceptable to the Owner and the Architect:

1. Submit on digital media acceptable to Architect, by uploading to web-based project software site, or by email to Architect. Enable reviewer comments on draft submittals.
 2. Submit three paper copies. Architect will return two copies.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.
- E. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.5 FORMAT OF OPERATION AND MAINTENANCE MANUALS

- A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- B. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.
1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf or post-type binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment. Enclose title pages and directories in clear plastic sleeves.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

1.6 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 1. Title page.
 2. Table of contents.
 3. Manual contents.
- B. Title Page: Include the following information:
 1. Subject matter included in manual.
 2. Name and address of Project.
 3. Name and address of Owner.
 4. Date of submittal.
 5. Name and contact information for Contractor.
 6. Name and contact information for Architect.
 7. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
 1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.7 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:
 - 1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
 - 2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
 - 3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.8 EMERGENCY MANUALS

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Content: Organize manual into a separate section for each of the following:
 - 1. Type of emergency.
 - 2. Emergency instructions.
 - 3. Emergency procedures.
- C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
 - 1. Fire.
 - 2. Flood.
 - 3. Gas leak.
 - 4. Water leak.
 - 5. Power failure.
 - 6. Water outage.
 - 7. System, subsystem, or equipment failure.
 - 8. Chemical release or spill.
- D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- E. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

1.9 SYSTEMS AND EQUIPMENT OPERATION MANUALS

- A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 2. Performance and design criteria if Contractor has delegated design responsibility.
 3. Operating standards.
 4. Operating procedures.
 5. Operating logs.
 6. Wiring diagrams.
 7. Control diagrams.
 8. Piped system diagrams.
 9. Precautions against improper use.
 10. License requirements including inspection and renewal dates.
- C. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
 2. Manufacturer's name.
 3. Equipment identification with serial number of each component.
 4. Equipment function.
 5. Operating characteristics.
 6. Limiting conditions.
 7. Performance curves.
 8. Engineering data and tests.
 9. Complete nomenclature and number of replacement parts.
- D. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
 2. Equipment or system break-in procedures.

3. Routine and normal operating instructions.
 4. Regulation and control procedures.
 5. Instructions on stopping.
 6. Normal shutdown instructions.
 7. Seasonal and weekend operating instructions.
 8. Required sequences for electric or electronic systems.
 9. Special operating instructions and procedures.
- E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

1.10 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.
1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.
- C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
 - a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 3. Identification and nomenclature of parts and components.
 4. List of items recommended to be stocked as spare parts.
- E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
 2. Troubleshooting guide.
 3. Precautions against improper maintenance.
 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 5. Aligning, adjusting, and checking instructions.
 6. Demonstration and training video recording, if available.
- F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.
- J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
1. Do not use original project record documents as part of maintenance manuals.
- 1.11 PRODUCT MAINTENANCE MANUALS
- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

- B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Product Information: Include the following, as applicable:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Color, pattern, and texture.
 - 4. Material and chemical composition.
 - 5. Reordering information for specially manufactured products.
- E. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.
- F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record specifications.
 - 3. Record Product Data.
 - 4. Miscellaneous record submittals.
- B. Related Requirements:
 - 1. Section 017300 "Execution" for final property survey.
 - 2. Section 017700 "Closeout Procedures" for general closeout procedures.
 - 3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit copies of Record Drawings as follows:
 - a. Initial Submittal:
 - 1) Submit PDF electronic files of scanned record prints and one set(s) of file prints.
 - 2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal:
 - 1) Submit PDF electronic files of scanned Record Prints and three set(s) of file prints.
 - 2) Print each drawing, whether or not changes and additional information were recorded.

- B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and Contract modifications.
- C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
 - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
- D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.
- E. Reports: Submit written report weekly indicating items incorporated into Project Record Documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

1.4 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
 - 1. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding photographic documentation.
 - 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing or diameter of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Construction Change Directive.
 - k. Changes made following Architect's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 4. Mark record prints with erasable, red-colored pencil or pen with red ink. Use other colors to distinguish between changes for different categories of the Work at same location.
 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Format: Annotated PDF electronic file with comment function enabled.
 3. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect.
 - e. Name of Contractor.

1.5 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation, where installation varies from that indicated in Specifications, addenda, and Contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
 5. Note related Change Orders, Record Product Data, and Record Drawings where applicable.
- B. Format: Submit record specifications as annotated PDF electronic file, paper copy, or scanned PDF electronic file(s) of marked-up paper copy of Specifications as acceptable to the Owner and the Architect.

1.6 RECORD PRODUCT DATA

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.

- B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 - 3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.
- C. Format: Submit Record Product Data as annotated PDF electronic file, paper copy, or scanned PDF electronic file(s) of marked-up paper copy of Product Data as acceptable to the Owner and the Architect.
 - 1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

1.7 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as PDF electronic file, paper copy, or scanned PDF electronic file(s) of marked-up miscellaneous record submittals as acceptable to the Owner and the Architect.
 - 1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

1.8 MAINTENANCE OF RECORD DOCUMENTS

- A. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Instruction in operation and maintenance of systems, subsystems, and equipment.
 - 2. Demonstration and training video recordings.

1.3 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Qualification Data: For facilitator and instructor.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
 - 1. Identification: On each copy, provide an applied label with the following information:
 - a. Name of Project.
 - b. Name and address of videographer.
 - c. Name of Architect.

- d. Name of Contractor.
 - e. Date of video recording.
- 2. Transcript: Prepared and bound in format matching operation and maintenance manuals. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding video recording. Include name of Project and date of video recording on each page.
 - 3. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
 - 4. At completion of training, submit complete training manual(s) for Owner's use prepared in same paper and PDF file format required for operation and maintenance manuals specified in Section 017823 "Operation and Maintenance Data."

1.5 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.
- D. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
 - 1. Inspect and discuss locations and other facilities required for instruction.
 - 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
 - 3. Review required content of instruction.
 - 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.7 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 - 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Systems and equipment operation manuals.
 - c. Systems and equipment maintenance manuals.
 - d. Product maintenance manuals.
 - e. Project Record Documents.
 - f. Identification systems.
 - g. Warranties and bonds.
 - h. Maintenance service agreements and similar continuing commitments.
 - 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
 - 4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.

- c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
- 5. Adjustments: Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
- 6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
- 7. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning.
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
- 8. Repairs: Include the following:
 - a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

1.8 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

1.9 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
 - 2. At the Owner's option, the Owner may furnish an instructor to describe Owner's operational philosophy.
 - 3. Owner will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner, through Architect, with at least seven days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral, a written, or a demonstration performance-based test.
- F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

1.10 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full HD mode with vibration reduction technology.
 - 1. Submit video recordings on CD-ROM or thumb drive or by uploading to web-based Project software site.
 - 2. File Hierarchy: Organize folder structure and file locations according to Project Manual table of contents. Provide complete screen-based menu.
 - 3. File Names: Utilize file names based on name of equipment generally described in video segment, as identified in Project specifications.
 - 4. Contractor and Installer Contact File: Using Microsoft Word, Microsoft Excel, other appropriate software, create a file for inclusion on the equipment demonstration and training recording that describes the following for each Contractor involved on the Project, arranged according to Project Manual table of contents:
 - a. Name of Contractor/Installer.

- b. Business address.
 - c. Business phone number.
 - d. Point of contact.
 - e. Email address.
- B. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
 - 1. Film training session(s) in segments not to exceed 15 minutes.
 - a. Produce segments to present a single significant piece of equipment per segment.
 - b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
- C. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
 - 1. Furnish additional portable lighting as required.
- D. Narration: Describe scenes on video recording by audio narration by microphone while or dubbing audio narration off-site after video recording is recorded. Include description of items being viewed.
- E. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.
- F. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION 017900

SECTION 019113 – COMMISSIONING GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes general requirements that apply to implementation of commissioning without regard to systems, subsystems, and equipment being commissioned.

1.2 DEFINITIONS

- A. CxA: Commissioning Authority.
- B. Systems, Subsystems, and Equipment: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, and equipment.
- C. TAB: Testing, Adjusting, and Balancing.

1.3 OTHER SECTIONS

- A. 230800 - Refer to Section 230800 for additional contractor requirements pertaining specifically to HVAC equipment commissioning support

1.4 SYSTEMS TO BE COMMISSIONED

- A. The following systems are to be commissioned for this project:
 - 1. HVAC
 - a. All HVAC Equipment (NEW): AHUs, Terminal Units, Pumps, Fans, Energy Recovery Equipment, supplemental heat/cool units (A/C Units, Heaters, etc)
 - b. Ductwork, piping, air distribution, insulation and all related accessories.
 - c. HVAC control system and building automation
 - d. HVAC Controls / BAS – Devices, sequences, graphics, functional testing, trend review
 - 2. Electrical
 - a. NONE
 - 3. Plumbing
 - a. NONE

1.5 COMMISSIONING TEAM

- A. Members Appointed by Contractor(s): Individuals, each having authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated actions. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.

B. Members Appointed by Owner:

1. CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CxA under a separate contract.
2. Representatives of the facility user and operation and maintenance personnel.
3. Architect and engineering design professionals.

1.6 CONTRACTOR'S RESPONSIBILITIES

A. Contractor and all subcontractors involved with commissioned systems and equipment shall assign representatives with expertise and authority to act on behalf of the Contractor/Subcontractor and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:

1. Work with the CxA to identify schedule requirements for all commissioning activities, and incorporate these activities into the overall project schedule, to ensure all required commissioning scope is properly completed prior to Occupancy. See SCHEDULE COORDINATION section below.
2. Participate in commissioning meetings.
3. Although contractors will not be required to complete Cx Installation Checklists, each relevant subcontractor shall be required to sign a "Contractor Pre-Cx Sign-Off" sheet for each requested system. This signed document is each contractor going on record, stating that the referenced equipment or system is 100% ready for Cx Functional Testing.
4. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend and implement corrective action.
5. Provide technicians who are familiar with the construction and operation of installed systems and who shall participate in functional performance testing of installed systems, subsystems, and equipment.
6. Provide qualified instructors to perform training sessions for Owner's operation and maintenance personnel.
7. Provide personnel to assist or perform seasonal or deferred testing as defined under other sections of the Specifications.
8. Provide prompt written responses to all identified issues identified during commissioning, including description of how each issue was or is to be addressed. Provide updated responses weekly as long as open issues remain on the Cx Master Issues Log.
9. Provide factory technicians to assist in testing or troubleshooting of equipment with sophisticated factory controls or electronics as required – Boilers, Chillers, VFDs, Generator/ATS, etc.
10. Fill in schedule target dates and milestones in HVAC Completion Matrix provided by CxA, to provide a detailed breakdown of schedule for HVAC equipment start-ups, completion of controls per system, TAB work, and start dates for Cx Functional Testing.

1.7 SCHEDULE COORDINATION – General Construction, HVAC Start-Ups, TAB, Controls, & Cx

A. **Building Cleanliness, HVAC Start-Ups, Controls, TAB, and Cx Functional Testing:** Contractor shall be responsible for providing an overall project schedule that provides the necessary time frames to complete Cx Functional Testing prior to owner turnover/occupancy. Cx Functional Testing shall not begin until after all building / HVAC control systems are 100% complete and all field TAB work is 100% complete. Schedule shall be finalized with the understanding that completion of all HVAC controls and TAB work hinges upon the general building construction and cleanliness that will allow equipment to be operated continuously, on a daily basis.

- B. **AHU Start-Ups:** Building must be relatively clean before starting up any AHU systems. Units shall not be operated in any capacity until all drywall/sanding and floor grinding work is 100% complete. If field activities are observed that continue to generate dirt/dust after AHU start-ups, contractor shall be responsible for cleaning of ductwork and unit interiors.
- C. **Temporary Conditioning:** Contractor shall provide a plan for temporary heating/cooling if building conditioning is required but AHUs or building systems are not ready to operate, or if general building conditions/cleanliness does not allow for AHU operation.
- D. **AHUs During Construction:** If the contractor requires that HVAC equipment be operational in order to prevent delays in project schedule, the GC shall request that the commissioning agent, design team, and owner inspect the status of ductwork and AHU cleanliness and grant permission to operate equipment. Contractor shall submit a written letter to accept responsibility for any duct/equipment cleaning that is required due to continued construction activity that continues to generate dust. HVAC contractor shall maintain temporary filter media to help keep ductwork, equipment, and coils clean, but use of filter media is not an acceptable “solution” to allow HVAC equipment to operate if general construction work continues to generate dirt and dust on a regular basis.
- E. **Start-Up Plan:** As part of the submittal process, contractor shall submit a coordinated HVAC equipment / system start-up plan with input from the HVAC contractor, and controls contractor to outline all expectations for equipment start-up including, but not limited to, description of building cleanliness and overall interior construction status as a pre-cursor to start ups, order of start-up activities (by system and by area), what level of controls and equipment safeties shall be in place at time of start-ups, required locations of filter media on HVAC grilles and diffusers, filter media maintenance plan during construction, use of temporary smoke detectors to allow 24/7 AHU operation if required, and protocol for shutting down units as required based on construction activity.
- F. **AHU Operation – OA vs RA:** HVAC start-up plan as well as completion schedule shall include specific differentiation between operating AHUs at 100% outdoor air versus allowing AHUs to pull return air from the space. Buildings are often not clean enough to pull return air at the time that contractors wish to start operating AHUs. For any time period that units are to operate at 100% outdoor air, return duct openings and grilles shall remain fully covered in plastic until the owner, design team, and Cx agent agree that the building is clean enough to pull return air. For time period of 100% OA operation, contractor(s) shall consider necessary precautions for freeze protection and proper temp/humidity control associated with 100% OA.
- G. **Fire/Smoke Dampers & AHU Start-Up:** Contractor HVAC start-up plan shall include intended approach to ensure that fire/smoke dampers are open throughout the building at time of AHU start-ups. Fire/smoke dampers are powered open through the fire alarm panel and the FACP will not be active at the time of AHU start-ups. Outline provisions to provide temporary power to open all fire/smoke dampers before start-ups. Acceptable means of opening dampers to allow AHU start-ups shall NOT include disconnecting damper linkages to manually open the fire/smoke dampers.
- H. **Schedule – AHU Operation:** Contractor’s initial schedule shall be required to include a date that the building will be clean enough to operate AHUs on a daily basis, to allow uninterrupted work on these systems by both controls and TAB contractor. This date shall be directly linked to the final project turnover date, with the understanding that failure to achieve this date will push back the turnover date. Contractor shall determine what month of the year that AHUs will be required to operate on a daily basis to meet project schedule and plan in advance for whether or not Heating Hot Water or Chilled Water systems (or both) will need to be functional before operating AHUs.
- I. **Substantial Completion FOR CX:** “Substantial Completion for Cx” shall be defined as follows: All BAS, Controls, Fire Alarm, and Test & Balance work 100% complete for all primary systems & equipment – AHUs, CHW System, HHW System, Terminal Units, & Exhaust Fans.
 - 1. For the BAS this shall include all programming, sequences, BAS graphics & floor plans, alarm set up, BAS trend points set up, occupancy schedules in place, and all set points finalized.

2. For Test & Balance this shall mean that all field TAB work is complete, AHUs have been finalized, all devices calibrated, exhaust systems complete, +/- pressurization rooms verified, and draft TAB report has been turned over to System WorCx
 3. For Electrical, this means that all fire alarm testing is 100% complete to avoid interruption of HVAC Equipment operating during ongoing FA testing
- J. **Schedule – Cx Testing:** Cx testing shall begin upon contractor(s) meeting all requirements for “Substantial Completion for Cx”. For this specific project, the schedule shall provide **TWO (2) weeks** between Substantial Completion for Cx and turnover of the building to the owner for move-in / occupancy. This will provide time for all Cx Functional testing as well as resolution of issues and re-testing of systems as necessary.
1. Phased Schedules: Cx Testing duration may be divided into phases to accommodate turnover of individual areas or buildings but only to the extent that it does not include systems that are partially complete. Example: AHUs cannot be functionally tested until CHW and HHW systems are substantially complete for Cx. If the CHW system serves multiple buildings, the controls and TAB work for the entire CHW system must be 100% complete before Cx Testing of AHUs can begin in any building.
- K. **BAS & Building Network:** Construction schedule and Substantial Completion for Cx shall be coordinated with building network to ensure that the BAS is fully integrated to the existing network and server at the start of Cx Functional Testing.
- L. **Schedule Ties:** Contractor schedule shall include ties between building clean, HVAC start-ups, controls completion, Test & Balance work, Substantial Completion for Cx, and building turnover to clearly outline that failure to meet any one of those dates has a direct impact on ability to achieve the final turnover date.
- M. **Schedule & Change Orders:** Contractor shall be responsible to evaluate the effect that any change order may have on the individual schedule milestones for building cleanliness, HVAC, Controls, TAB or Cx. If a change order is believed to impact any of these dates, owner shall be made aware and the building turnover date shall be adjusted accordingly. (Unless contractor coordinates with all trades to determine an agreed upon approach for overtime work to make up schedule days). At no point shall the contractor attempt to shorten the duration or number of days provided to complete BAS/Controls, TAB, or Cx Testing as a means of recovering schedule days.
- N. **TAB Start Requirements:** Contractor schedule start date for TAB activities shall be appropriately linked to HVAC, Start-Up, and Controls schedule dates to ensure that entire systems are ready for TAB work to commence.
1. Air Side TAB: Shall not begin until corresponding AHU is under proper static pressure control, all spaces are free dirt/dust, all connected VAV boxes have been energized and are under control, all ceiling grid and diffusers are in place.
 2. Water Side TAB: BAS network shall be far enough along that valves throughout the building can be globally commanded open/closed. All DP sensors shall be in place and pumps shall be under BAS control.
- O. **TAB Support / Coordination:** For any areas of the building that require a lift to access ductwork or volume dampers for TAB work, contractor shall provide and coordinate lift for use by TAB contractor.
- P. **Equipment Cleaning:** It shall be the responsibility of the General Contractor to ensure that all equipment and systems are turned over to the owner free of dirt, dust, debris. If HVAC contractor is required to operate AHUs before building is clean, the Contractor shall ensure every measure is taken to protect ductwork and AHUs. Site work / grading shall be coordinated and scheduled to avoid air-borne dust/dirt that can get drawn into air-cooled condensing equipment (ie...chillers or A/C condensing units) or drawn into OA intake louvers. If equipment must be operational while dust-generating activities take place on site, Contractor shall cover expense to have all outdoor equipment thoroughly cleaned upon completion of all site activities.

1.8 CxA'S RESPONSIBILITIES (FOR CONTRACTOR INFORMATION ONLY)

- A. Organize and lead the commissioning team.
- B. Review and comment on submittals from Contractor for compliance with Contract Documents.
- C. Convene commissioning team meetings for the purpose of coordination, communication, and conflict resolution; discuss progress of the commissioning processes. Responsibilities include arranging for facilities, preparing agenda and attendance lists, and notifying participants. The CxA shall prepare and distribute minutes to commissioning team members and attendees within five workdays of the commissioning meeting.
- D. At the beginning of the construction phase, conduct an initial construction-phase coordination meeting for the purpose of reviewing the commissioning activities and establishing tentative schedules for operation and maintenance submittals; operation and maintenance training sessions; TAB Work; and Project completion.
- E. Observe construction and report progress and deficiencies. Observe systems and equipment installation for consistency with contract documents and required national standards, implementation of IAQ management practices, adequate accessibility for maintenance and component replacement or repair.
- F. Prepare Project-specific construction checklists for each piece of equipment and component associated with commissioned systems.
- G. Field-verify proper installation of all commissioned systems.
- H. Prepare Project-specific functional performance test procedures to verify system performance, interoperability, and sequences of operation.
- I. Direct, witness, and document functional performance tests, with systems and equipment operated by the Contractor.
- J. Compile test results and baseline data and include them in the systems manual and commissioning report.
- K. Prepare commissioning reports.
- L. Assemble the final commissioning documentation, including the commissioning report and Project Record Documents.

1.9 COMMISSIONING DOCUMENTATION

- A. Construction Checklists: CxA will provide checklists for major pieces of equipment for the Contractor to reference as guidelines for field-reviews by the CxA. The Contractor does not have to complete or submit these checklists. However, contractor shall be required to notify CxA when installation is 100% complete for each piece of equipment or system, and ready for final Cx installation verification.
- B. Functional Performance Test Procedures: CxA shall develop functional performance test procedures for each system, subsystem, or equipment including interfaces and interlocks, and include a separate entry, with space for comments, for each item to be tested. Provide space for testing personnel to sign off on each checklist. Each test procedure shall include, but not be limited to, the following:
 - 1. Name and identification code of tested item.
 - 2. Time and date of test.
 - 3. Calibration of sensors and sensor function.

4. Testing conditions under which test was conducted, including (as applicable) ambient conditions, set points, override conditions, and status and operating conditions that impact the results of test.
 5. Control sequences.
 6. Responses to control signals at specified conditions.
 7. Sequence of response(s) to control signals at specified conditions.
 8. Expected performance of systems, subsystems, and equipment at each step of test.
 9. Interaction of auxiliary equipment and interfaces with other systems.
 10. Setpoints.
 11. Deficiencies.
- C. Certificate of Readiness: Certificate of Readiness shall be signed by Contractor, Subcontractor(s), Installer(s), and CxA certifying that systems, subsystems, equipment, and associated controls are ready for testing (see form at the end of this section).
- D. Test Reports: CxA shall record test data, observations, and measurements on test procedures and test logs. Photographs, forms, and other means appropriate for the application shall be included with data. CxA shall compile test reports and include them in systems manual and commissioning report.
- E. Corrective Action Documents: CxA shall document corrective action taken for systems and equipment that fail tests. Include required modifications to systems and equipment and revisions to test procedures, if any. Retest systems and equipment requiring corrective action and document retest results.
- F. Issues Log: CxA shall prepare and maintain an issues log that describes design, installation, and performance issues that are at variance with the OPR, BoD, and Contract Documents. Identify and track issues as they are encountered, documenting the status of unresolved and resolved issues.
- G. Commissioning Report: CxA shall document results of the commissioning process including unresolved issues and performance of systems, subsystems, and equipment. The commissioning report shall include, but is not limited to, the following:
1. Testing plans and reports.
 2. Issues log.
 3. Completed test checklists.
 4. Listing of off-season test(s) not performed and a schedule for their completion.

1.10 SUBMITTALS

- A. The contractor shall provide one copy of each submittal for equipment related to commissioned equipment to the CxA at the time it is submitted to the Architect. The Contractor shall include all information necessary to prepare startup checklists and functional performance test procedures, including performance data, sequences of operation, and manufacturer's startup checklists.
- B. The CxA will forward any submittal comments to the Architect/Engineer prior to the submittals being returned to the Contractor. The CxA may request additional submittal information from the Contractor needed to complete the commissioning process. The Contractor shall gather the requested information and resubmit it to the CxA.
- C. Construction Checklists and Functional Performance Test Procedures: CxA shall submit sample checklists and forms to Contractor quality-control manager and subcontractors for review and comment. Submit two copies of each checklist and report form.
- D. Contractor shall submit results and reports from all manufacturer startup or special field-testing services within seven days of completion.

- E. Certificates of Readiness / Pre-Cx Sign-Off: Contractor shall submit Certificates of Readiness (see form at the end of this section).

1.11 COORDINATION

- A. Reporting: CxA shall distribute commissioning field reports, periodically updated issues logs, test results, and other documents generated by the CxA to the commissioning team. All information will be copied to the Owner's representatives. The Contractor shall respond to all items noted in each commissioning field report within seven (7) days. The response shall note the intended action or response by the Contractor, and indicate a date for correction or resolution of the issue.
- B. Scheduling: Refer to section 1.6.
- C. Commissioning Meetings: CxA shall conduct periodic commissioning meetings of the commissioning team to review the issues log, progress on the commissioning plan, to discuss scheduling conflicts, and to discuss upcoming commissioning process activities.
- D. Testing Coordination: Contractor shall coordinate sequence of testing activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting, and to ensure all testing activities can be completed prior to Occupancy, including allowance for time to correct any deficiencies.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 BASIC COMMISSIONING PROCESS

- A. The following outlines the basic process of commissioning.
 - 1. Commissioning during construction begins with a scoping meeting conducted by the CxA where the commissioning process is reviewed with the commissioning team members.
 - 2. Additional meetings will be required throughout construction, scheduled by the CxA with necessary parties attending, to plan, scope, coordinate, schedule future activities and resolve problems.
 - 3. CxA maintains and distributes a Master Issues Log to track all deficiencies through to resolution.
 - 4. Equipment documentation is submitted to the CxA during normal submittals, including detailed start-up procedures.
 - 5. In general, the checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels with construction checklists being completed before functional testing, and functional testing completed before integrated system testing.
 - 6. The Contractor and Subcontractors, under their own direction, execute and document startup and initial checkout. The Contractor notifies the CxA in advance of all activities. The CxA documents that the startups were completed according to the approved plans. This may include the CxA witnessing start-up of selected equipment.
 - 7. The Contractor and Subcontractors, under their own direction, execute and document all testing required by the Specifications, such as load bank testing, electrical testing, air barrier testing, etc. The Contractor notifies the CxA in advance of all activities. The CxA documents that the startups were completed according to the approved plans. This may include the CxA witnessing start-up of selected equipment.
 - 8. The CxA develops specific equipment and system functional performance test procedures. The Contractor reviews the procedures.

9. The functional test procedures are executed by the Contractor, under the direction of, and documented by the CxA.
10. Items of non-compliance in material, installation or setup are corrected at the Contractor's expense and the system retested.
11. The Contractor provides and installs load banks in preparation for the Integrated System Testing.
12. The CxA reviews the O&M documentation for completeness.
13. Commissioning is completed before Substantial Completion.
14. The CxA reviews, pre-approves and coordinates the training provided by the Contractor and verifies that it was completed.
15. Deferred and seasonal testing is conducted by the Contractor, as specified or required, under the direction of the CxA. The CxA coordinates the scheduling through the Contractor.
16. The CxA performs post-occupancy evaluations after approximately two months and ten months of occupancy to identify any issues or deficiencies. Deficiencies shall be addressed by the Contractor prior to expiration of any warranties.

3.2 TESTING PREPARATION

- A. REVER TO SECTION 230800 FOR ADDITIONAL CX REQUIREMENTS SPECIFIC TO HVAC SYSTEMS AND EQUIPMENT

3.3 Test and Balance (TAB) VERIFICATION

- A. TAB subcontractor shall coordinate with CxA for work required in Division 23 Section "Testing, Adjusting, and Balancing." TAB subcontractor shall copy CxA with required reports, sample forms, checklists, and certificates.
- B. TAB Contractor shall provide notice of activities that involve determination of operating set points for AHUs, HHW, or CHW systems (finalizing AHUs for static pressure set points, fan speeds/limits, damper control set points, pump DP set points, etc). CxA shall witness these activities as part of the overall TAB verification effort.
- C. Cx TAB Verification:
 1. CxA shall work directly with the TAB contractor during setup and finalization of primary Air Handling Units to confirm general TAB accuracy, means, and methods. Upon request, TAB contractor shall take airflow readings at individual grilles and diffusers to verify final airflow numbers match submitted TAB report. Sampling not to exceed 10% of airflow devices.
- D. Failure of more than 10% of demonstrated readings to fall within 10% of the airflow numbers documented on TAB report shall be considered failure of the TAB effort in general for that particular system. In instances where this occurs, the TAB contractor shall revisit all remaining devices on their own and make adjustments to individual outlets and/or the system as a whole before continuing Cx TAB verification.
- E. CxA shall verify that TAB Work has been successfully completed.

CERTIFICATE OF READINESS

Contractor has verified that the following prerequisite items have been completed in preparation for the functional testing phase of the commissioning process.

System to Be Commissioned: _____

☐ The system to be commissioned, including all equipment, ductwork, piping, electrical, plumbing, and interfaces to other systems is complete, installed per the Contract Documents, and any issues previously identified by the Commissioning Team have been addressed.

☐ All equipment has been properly started up by qualified personnel. Where specified, the startup was conducted by the manufacturer. Startup procedures and reports have been documented and provided to the CxA.

☐ For HVAC systems, all duct pressure testing, duct cleaning, pipe pressure testing, and pipe flushing has been completed according to the Contract Documents.

☐ For HVAC systems, the Test and Balance work is complete, all issues have been corrected, and a final (draft) report has been provided to the CxA.

☐ For Building Automation system (BAS), the BAS contractor has completed their own checkout procedures, including but not limited to the following:

- Calibration of all sensors.
- Point-to-Point checks of all sensors and devices.
- Checks of all devices (dampers, control valves, etc.) for proper operation, fail position, and verification of no leakage.
- Programming of all sequences of operations, alarms, and setpoints.
- Completion and check of all graphics.
- Interface with other systems (lighting, plumbing, metering, etc.).

☐ All equipment and systems are online and operating with no restrictions for testing.

☐ All necessary notifications, coordination and scheduling have been considered that might be required for functional testing of this system (e.g. Owner, Fire Marshall, Occupants, etc.).

Attach a list any known exceptions or outstanding issues related to the above statements.

List name, title, company, date: _____

I have verified that the above statements are true and that the system is ready for functional testing by the CxA, except for those items noted as attached. I understand that if it is found that the system has not been properly prepared as per the above, necessitating one or more return site visits by the CxA, the Construction Team may be charged by the Owner for the CxA's additional time, including travel time plus travel expenses.

Signature: _____

END OF SECTION 011913

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SECTION 033000 - CAST-IN-PLACE CONCRETE FOR BUILDINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
 - 1. Include special reinforcement required for openings through concrete structures and dimensioned opening locations. Include applicable dimensions, sections, elevations, and details required to complete installation and coordination of the details, and typical details. Plan shall be drawn at a scale of no less than 1/8" per foot.

1.6 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Steel reinforcement and accessories.
 - 4. Waterstops.
 - 5. Curing compounds.
 - 6. Floor and slab treatments.
 - 7. Vapor retarders.
- B. Material Test Reports: For the following, from a qualified testing agency:
 - 1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
 - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.10 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 305.1 and as follows:
 - 1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301.
 - 2. ACI 117.
 - 3. ACI 315.
 - 4. CRSI "Manual of Standard Practice."
 - 5. ACI 318.

2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

- D. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- E. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.

2.4 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.5 CONCRETE MATERIALS

- A. Source Limitations: Obtain each type or class of cementitious material (cement and fly ash) of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer for all concrete in this Division 033000 "Cast-In-Place Concrete for Buildings" and Division 321313 "Concrete Paving". Contractor shall be responsible for coordinating this requirement between trades and sub-contractors such that exposed concrete on the project for building slabs and pavement have a consistent appearance.
- B. Cementitious Materials:
 - 1. Portland Cement: ASTM C 150/C 150M, Type I/ II, gray.
 - 2. Fly Ash: ASTM C 618, Class F.

- C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
 - 1. Maximum Coarse-Aggregate Size: 1-1/2 inches, nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Air-Entraining Admixture: ASTM C 260/C 260M.
- E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- F. Water: ASTM C 94/C 94M and potable.

2.6 WATERSTOPS

- A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.

2.7 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class A, with maximum water-vapor permeance of 0.01 perms per ASTM E 96. Include manufacturer's recommended adhesive or pressure-sensitive tape, 15 mil thickness.

2.8 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

- F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.9 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
- B. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

2.10 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 - 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.11 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash: 25 percent.

- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete, and concrete with a w/c ratio below 0.50.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings: Normal-weight concrete.
 - 1. Minimum Compressive Strength: 3000 psi at 28 days.
 - 2. Slump Limit: 4 inches, plus or minus 1 inch.
 - 3. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
- B. Slabs-on-Grade: Normal-weight concrete.
 - 1. Minimum Compressive Strength: 4000 psi at 28 days.
 - 2. Maximum W/C Ratio: 0.50.
 - 3. Minimum Cementitious Materials Content: 470 lb/cu. yd.
 - 4. Slump Limit: 4 inches, plus or minus 1 inch or 8 inches maximum for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture.
 - 5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
- C. Slabs-on-Grade at Apparatus Bays: Normal-weight concrete.
 - 1. Minimum Compressive Strength: 4500 psi at 28 days.
 - 2. Maximum W/C Ratio: 0.45.
 - 3. Minimum Cementitious Materials Content: 470 lb/cu. yd.
 - 4. Slump Limit: 4 inches, plus or minus 1 inch or 8 inches maximum for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture.
 - 5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
- D. Supported Floor Slabs: Normal-weight concrete.
 - 1. Minimum Compressive Strength: 4000 psi at 28 days.
 - 2. Maximum W/C Ratio: 0.50.
 - 3. Minimum Cementitious Materials Content: 470 lb/cu. yd.
 - 4. Slump Limit: 4 inches, plus or minus 1 inch or 8 inches maximum for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture.
 - 5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
- E. Exterior Slabs-on-Grade: Normal-weight concrete.
 - 1. Minimum Compressive Strength: 4500 psi at 28 days.
 - 2. Maximum W/C Ratio: 0.45.

3. Minimum Cementitious Materials Content: 470 lb/cu. yd.
4. Slump Limit: 4 inches, plus or minus 1 inch or 8 inches maximum for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture.
5. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.

F. All Other Concrete: Normal-weight concrete.

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum W/C Ratio: 0.50.
3. Minimum Cementitious Materials Content: 470 lb/cu. yd.
4. Slump Limit: 4 inches, plus or minus 1 inch or 8 inches maximum for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture.
5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

G. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.13 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
 1. Class A, 1/8 inch for smooth-formed finished surfaces.
 2. Class C, 1/2 inch for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 1. Do not use rust-stained steel form-facing material.

- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEM INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.

3.3 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.4 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.5 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 - 3. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks. Joints shall be cut the same day slab is placed and no longer than 8 hours after concrete placement.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
 - 2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.6 WATERSTOP INSTALLATION

- A. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.7 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 4. Slope surfaces uniformly to drains where required.
 - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.8 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces exposed to public view.

- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.9 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
 - 1. Apply scratch finish to surfaces to receive mortar setting beds for bonded cementitious floor finishes.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces to receive trowel finish.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet and apparatus bay floors to receive sealed finish.
 - 2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
 - a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thinset method (first and second floor slab areas). While concrete is still plastic, slightly scarify surface with a fine broom.
 - 1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

3.10 MISCELLANEOUS CONCRETE ITEM INSTALLATION

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases to height indicated, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
3. Minimum Compressive Strength: 3000 psi at 28 days.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
6. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

- C. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces. Concrete shall be normal weight with minimum compressive strength of 3000 psi.

3.11 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305.1 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.

- a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.12 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.13 SPECIAL INSPECTIONS

- A. Special Inspections will be performed by the Owner's Special Inspector.
- B. Verification and inspection of concrete construction shall be in accordance with the 2018 North Carolina State Building Code and as follows:
- C. Inspections:
1. Steel reinforcement placement.
 2. Headed bolts and studs.
 3. Verification of use of required design mixture.

4. Concrete placement, including conveying and depositing.
 5. Curing procedures and maintenance of curing temperature.
- D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:
1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure five 4 x 8 standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C 39/C 39M; test one laboratory-cured specimen at 7 days and one set of three specimens at 28 days. Maintain one specimen in reserve for later testing, if required.
 - a. A compressive-strength test shall be the average compressive strength from a set of specimens obtained from same composite sample and tested at age indicated.
 - b. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
 7. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
 8. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
 9. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

Bid Documents

- F. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- G. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.
- H. Prepare test and inspection reports.

END OF SECTION 033000

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SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Concrete masonry units.
2. Clay face brick.
3. Mortar and grout.
4. Steel reinforcing bars.
5. Masonry-joint reinforcement.
6. Ties and anchors.
7. Embedded flashing.
8. Miscellaneous masonry accessories.

- B. Related Sections include the following:

1. Division 01 Section "Special Inspections Services."
2. Division 01 Section "Construction Waste Management and Disposal" for waste disposal.
3. Division 07 Section "Bituminous Dampproofing."
4. Division 07 Section "Self-Adhering Sheet Waterproofing."
5. Division 07 Section "Thermal Insulation" for cavity wall insulation.
6. Division 07 Section "Fire Resistive Joint Systems."
7. Division 07 Section "Joint Sealants."

- C. Products Installed but not Furnished under This Section:

1. Cast-stone trim in unit masonry.
2. Steel lintels in unit masonry.
3. Steel shelf angles for supporting unit masonry.
4. Cavity wall insulation.
5. Hollow metal frames in unit masonry openings.

- D. Related Requirements:

1. Section 072100 "Thermal Insulation" for cavity wall insulation.
2. Section 076200 "Sheet Metal Flashing and Trim" for sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For the following:
 - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 - 2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.
 - 3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- C. Samples for Initial Selection:
 - 1. Clay face brick, in the form of straps of five or more bricks.
 - a. Architect will select no more than (3) of each type, selections which will be required to be submitted as sample panels.
 - 2. Colored mortar.
 - a. Architect will select no more than (6) colored mortar selections which will be required to be submitted as sample panels.
 - 3. Weep holes/cavity vents.

1.5 INFORMATIONAL SUBMITTALS

- A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
 - 1. Submittal is for information only. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.
- B. Qualification Data: For testing agency.
- C. Material Certificates: For each type and size of the following:
 - 1. Masonry units.
 - a. Include data on material properties and, if required by authorities having jurisdiction, material test reports substantiating compliance with requirements.
 - b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
 - c. For exposed brick, include test report for efflorescence according to ASTM C67.
 - d. For surface-coated brick, include test report for durability of surface appearance after 50 cycles of freezing and thawing according to ASTM C67 or a list of

- addresses of buildings in Project's area where proposed brick has been used successfully and with a history of durability.
- e. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
- f. Initial rate of absorption for face brick.
- 2. Cementitious materials. Include name of manufacturer, brand name, and type.
- 3. Mortar admixtures.
- 4. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
- 5. Grout mixes. Include description of type and proportions of ingredients.
- 6. Reinforcing bars.
- 7. Joint reinforcement.
- 8. Anchors, ties, and metal accessories.
- D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
 - 1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
 - 2. Include test reports, according to ASTM C1019, for grout mixes required to comply with compressive strength requirement.
- E. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C1093 for testing indicated.
- B. Sample Panels: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.
 - 1. Build sample panels for each type of exposed unit masonry construction in sizes approximately 60 inches long by 48 inches high by full thickness.
 - 2. Build sample panels facing south.
 - 3. Protect approved sample panels from the elements with weather-resistant membrane.
 - 4. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
 - a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless Architect specifically approves such deviations in writing.
- C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockups for typical exterior wall in sizes approximately 60 inches long by 60 inches high by full thickness, including face and backup wythes and accessories.
 - a. Include a sealant-filled joint at least 16 inches long in exterior wall mockup.
 - b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches wide by 16 inches high.
 - c. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
 - d. Include studs, sheathing, water-resistive barrier, sheathing joint-and-penetration treatment, air barrier, veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.
2. Protect accepted mockups from the elements with weather-resistant membrane.
3. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
 - a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
 - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 REFERENCES

- A. ASTM C33 – Specification for Concrete Aggregates
- B. ASTM C150 – Specification for Portland Cement
- C. PCI – Manual for Quality Control for Precast and Prestressed Concrete MNL-116.
- D. ACI- Building Code Requirements for Structural Concrete, ACI -318 and ACI – 530.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

- D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 FIELD CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
 - 2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe, and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
 - 1. When ambient temperatures exceed 100 deg. F or, 90 deg. F with wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set Masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops indicated net-area compressive strengths at 28 days.
 - 1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.
 - 2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C1314.

2.3 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 feet vertically and horizontally of a walking surface.
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
 - 1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.4 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - 1. Provide bullnose units for outside corners, wall ends and jambs at openings at all new walls, unless otherwise indicated.
 - 2. Provide special shapes for lintels, relief angles, corners, jambs, sash, control joints, headers, bonding, pilasters and other special conditions.
 - 3. Provide standard units below grade for exterior walls of nominal size 8 x 8 x 16 CMU, 8 x 6 x 16 CMU and 4 x 8 x 16 CMU as indicated.

4. Provide standard units above grade of nominal size 8 x 12 x 16 CMU, 8 x 8 x 16 CMU, 8 x 6 x 16 CMU and 4 x 8 x 16 CMU as indicated.
- B. All concrete masonry units shall be kept free from coal cinder aggregate, waste products, organic impurities, and any other deleterious substance that will cause rusting, staining or pop outs.
- C. CMUs: ASTM C90.
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi unless otherwise indicated on the Structural Drawings.
 2. Density Classification: Lightweight unless otherwise indicated on the Structural Drawings.
 3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
 4. Expand Faces: Manufacturer's standard color and texture, unless otherwise indicated.
 - a. Where units are to be left exposed, provide color and texture matching the range represented by Architects Sample.

2.5 CONCRETE AND MASONRY LINTELS

- A. Masonry Lintels: Built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.6 BRICK

- A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:
1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 2. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing as determined by Architect or where indicated. Provide special shapes for corners that are more or less than ninety-degree corners. Provide special shapes to cover relief angles.
 - a. Special shapes notched brick at lintel.
 - b. Special shaped brick at sill
 3. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
 4. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
 5. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
 6. Provide formed corner caps for wall corners and wall ends. Corner caps to be provided in size, profile, and scoring to match adjacent brick wall cap configuration. Corner caps to

be scored with false mortar head joints to minimize size and spacing of adjacent wall cap. Cap dimensions to be same width as wall cap, each way, thickness and profile to match wall cap.

B. Clay Face Brick: Facing brick complying with ASTM C216, SW, Type FBS, and as follows,

1. Brick Type:

a. Color and Texture:

- 1) Brick Color 1 – Pearl Gray Modular Wirecut by Taylor Clay Products
- 2) Brick Color 2 – Flat Set Red Brown Flashed Wirecut by Meridian Brick
- 3) Brick Color 3 – Chocolate Modular Wirecut by Meridian Brick

b. Special Shapes:

- 1) Custom Brick Watertable: As approved by the Architect.
- 2) Brick Rowlock Cap: As approved by the Architect.

2. Grade: SW.

3. Type: FBX or FBS.

4. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3350 psi unless otherwise indicated on the Structural Drawings.

5. Initial Rate of Absorption: Less than 20 g/30 sq. in. per minute when tested according to ASTM C67.

6. Efflorescence: Provide brick that has been tested according to ASTM C67 and is rated "not effloresced."

7. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing according to ASTM C67 with no observable difference in the applied finish when viewed from 10 feet or shall have a history of successful use in Project's area.

2.7 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Do not use Calcium Chloride in mortar or grout. Provide natural color or white cement as required to produce mortar color indicated.

1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.

E. Colored Cement Products: Packaged blend made from portland cement and hydrated lime or masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Colored Masonry Cement:
 - a. Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Capital Materials Corporation; Flamingo Color Masonry Cement.
 - 2) Cemex S.A.B. de C.V.; Richcolor Masonry Cement.
 - 3) Essroc, Italcementi Group; Brixment-in-Color.
 - 4) Holcim (US) Inc.; Rainbow Mortamix Custom Color Masonry Cement.
 - 5) Lafarge North America Inc.; U.S. Cement Custom Color Masonry Cement.
 - 6) Lehigh Cement Company; Lehigh Custom Color Masonry Cement.
 - 7) National Cement Company, Inc.; Coosa Masonry Cement.
2. Locations:
 - a. All exposed mortar in face brick is to be factory colored blend.
 - b. Color #1 is to match Architect's sample.
 - c. Color #2 is to match Architect's sample.
3. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
4. Pigments shall not exceed 10 percent of portland cement by weight.

F. Aggregate for Mortar: ASTM C144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

G. Aggregate for Grout: ASTM C404.

H. Water: Potable.

2.8 REINFORCEMENT

- A. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
- B. Masonry-Joint Reinforcement, General: ASTM A951/A951M.
 1. Interior Walls: Hot-dip galvanized carbon steel.
 2. Exterior Walls: Hot-dip galvanized carbon steel.
 3. Wire Size for Side Rods: W1.7 or 0.148 inch diameter.
 4. Wire Size for Cross Rods: W1.7 or 0.148 inch diameter.
 5. Wire Size for Veneer Ties: W1.7 or 0.148 inch diameter.
 6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
 7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

8. Provide in width appropriate to type of masonry being installed. Side rods to be positioned not less than $\frac{3}{4}$ inch nor more than $1\frac{1}{4}$ inch from each face of masonry unit except within the center half at 4 inch thick masonry units.
- 9.

C. Masonry-Joint Reinforcement for Multiwythe Masonry:

1. Ladder type with one side rod at each face shell of hollow masonry units more than 4 inches wide, plus one side rod at each wythe of masonry 4 inches wide or less.
2. Tab type, either ladder or truss design, with one side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe, but with at least $\frac{5}{8}$ -inch cover on outside face.
3. Adjustable (two-piece) type with single pair of side rods and cross ties spaced not more than 16 inches o.c. and with separate adjustable veneer ties engaging the cross ties. Cross ties are either U-shaped with eyes or rectangular. Space side rods for embedment within each face shell of backup wythe and size adjustable ties to extend at least halfway through outer wythe but with at least $\frac{5}{8}$ -inch cover on outside face.
 - a. Use where indicated and where horizontal joints of facing wythe do not align with those of backup wythe.
 - b. Use where facing wythe is of different material than backup wythe.

2.9 TIES AND ANCHORS

- A. General: Ties and anchors shall extend at least 1-1/2 inches into veneer but with at least a $\frac{5}{8}$ -inch cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82/A82M, with ASTM A153/A153M, Class B-2 coating.
 2. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.
 3. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.
 1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units.
 2. Where wythes do not align or are of different materials, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.
 3. Wire: Fabricate from $\frac{3}{16}$ -inch-diameter, hot-dip galvanized steel wire.
- D. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 1. Anchor Section for Welding to Steel Frame: Crimped $\frac{1}{4}$ -inch-diameter, hot-dip galvanized steel wire.

2. Tie Section: Triangular-shaped wire tie made from 0.187-inch- diameter, hot-dip galvanized steel wire.
- E. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.105-inch-thick steel sheet, galvanized after fabrication.
 - a. 0.064-inch- thick, galvanized-steel sheet may be used at interior walls unless otherwise indicated.
 2. Tie Section: Triangular-shaped wire tie made from 0.187-inch- diameter, hot-dip galvanized steel wire.
 3. Corrugated-Metal Ties: Metal strips not less than 7/8 inch wide with corrugations having a wavelength of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch made from 0.060-inch-thick steel sheet, galvanized after fabrication with dovetail tabs for inserting into dovetail slots in concrete.
 - a. 0.064-inch- thick galvanized sheet may be used at interior walls unless otherwise indicated.
- F. Partition Top Anchors: 0.105-inch-thick metal plate with a 3/8-inch-diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.
- G. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.
1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A153/A153M.
- H. Adjustable Masonry-Veneer Anchors:
1. General: Provide anchors that allow vertical adjustment but resist a 100-lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
 2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.075-inch-thick steel sheet, galvanized after fabrication.
 3. Fabricate wire ties from 0.187-inch- diameter, hot-dip galvanized-steel wire unless otherwise indicated.
 4. Contractor's Option: Unless otherwise indicated, provide any of the adjustable masonry-veneer anchors specified.
 5. Screw-Attached, Masonry-Veneer Anchors: Wire tie and a rib-stiffened, sheet metal anchor section with screw holes top and bottom, with projecting tabs having holes for inserting vertical legs of wire tie formed to fit anchor section.
 6. Screw-Attached, Thermally-Isolated Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section. Use where masonry veneer is anchored to exterior metal-framing/sheathing assembly,
 - a. Anchor Section: Corrosion-resistant, self-drilling, eye-screw designed to receive manufacturer's standard bent-wire tie. Eye-screw to have integral spacer that

penetrates sheathing and seats directly against framing and is same thickness as sheathing and has gasketed washer head that seals to sheathing.

- 1) Provide anchor type compatible with each type of backup construction:
 - a) Sheathing on Metal Stud Framing.
- 2) Provide barrel shaft and screw of length required to be compatible with insulation and sheathing thicknesses.
- 3) Provide anchors with integral cap and sealing washer to seal to and restrain board insulation.
- 4) Minimum veneer Embed depth: 1 3/4 inches. Bolts and anchors shall be solidly embedded in mortar or grout.
- 5) Basis-of-design: Provide "2-Seal Thermal Wing Nut Anchor" by Hohmann & Barnard, Inc, or approved equal.
- 6) Bent Wire Tie: Provide in lengths as required to be embedded into not less than 1 3/4" while maintaining not less than 3/4" mortar cover at exterior face.
7. Screw-Attached, Masonry-Veneer Anchors: Wire tie and a corrosion-resistant, self-drilling, eye-screw designed to receive wire tie. Eye-screw has spacer that seats directly against framing and is same thickness as sheathing and has gasketed washer head that covers hole in sheathing.
8. Seismic Masonry-Veneer Anchors: Wire tie and a rib-stiffened, sheet metal anchor section with screw holes top and bottom, with projecting tabs having holes for inserting vertical legs of wire tie formed to fit anchor section. Wire tie has sheet metal clip welded to it with integral tabs designed to engage continuous wire.
9. Stainless Steel Drill Screws for Steel Studs: ASTM C954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 diameter by length required to penetrate steel stud flange with not less than three exposed threads; either made from Type 410 stainless steel or made with a carbon-steel drill point and 300 Series stainless steel shank.

2.10 MISCELLANEOUS ANCHORS

- A. Postinstalled Anchors: Anchors as described below, with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
 1. Type: Chemical anchors.
 2. Type: Expansion anchors.
 3. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors.
 4. For Postinstalled Anchors: Capability to sustain, without failure, a load equal to six times the loads imposed.

2.11 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
 1. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.019 inch thick (26 gauge).

2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
3. Fabricate through-wall metal flashing embedded in masonry from stainless steel, with ribs at 3-inch intervals along length of flashing to provide an integral mortar bond.
4. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
5. Fabricate through-wall flashing with sealant stop where indicated. Fabricate by bending metal back on itself 3/4 inch at exterior face of wall and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
6. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
7. Fabricate metal sealant stops from stainless steel. Extend at least 3 inches into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
8. Fabricate metal expansion-joint strips from stainless steel to shapes indicated.
9. Solder metal items in the corners.
10. Foil-faced, rolled flashing will not be accepted.
11. Fabricate through-wall flashing with snap lock receiver on exterior face where indicated to receive counterflashing.

B. Flexible Flashing:

1. Copper-Laminated Flashing: 5-oz./sq. ft. copper sheet bonded between two layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Copper Fabric; AFCO Products Inc.
 - 2) Type FCC-Fabric Covered Copper; Phoenix Building Products.
 - 3) Copper Fabric Flashing, Sandell Manufacturing CO. Inc.
 - 4) York Copper Fabric Flashing; York Manufacturing Inc.

C. Application: Unless otherwise indicated, use the following:

1. Where flashing is indicated to receive counterflashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge or flexible flashing with a metal drip edge.
4. Where flashing is fully concealed, use metal flashing or flexible flashing.

D. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 "Sheet Metal Flashing and Trim."

1. Solder for Stainless Steel: ASTM B32, Grade Sn60, with acid flux of type recommended by stainless steel sheet manufacturer.

E. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

- F. Termination Bars for Flexible Flashing: Stainless steel bars 0.075 inch by 1 inch or stainless steel sheet 0.019 inch by 1-1/2 inches with a 3/8 inch sealant flange at top.

2.12 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).
- D. Weep/Cavity Vent Products: Use the following unless otherwise indicated:
 - 1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Advanced Building Products Inc.; Mortar Maze Cell Vent.
 - 2) Heckmann Building Products, Inc.; No. 85 Cell Vent.
 - 3) Hohmann & Barnard, Inc; QV Quadro-Vent.
 - 4) Mortar Net Solutions.
 - 5) Wire-Bond; Cell Vent (#3601).
- E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Mortar Net Solutions MortarNet with Insect Barrier or WallDefender, or comparable product by one of the following:
 - a. Advanced Building Products, Inc.
 - b. CavClear/Archovations, Inc.
 - c. Heckmann Building Products, Inc.
 - d. Wire-Bond.
 - 2. Configuration: Provide one of the following:
 - a. Strips, full depth of cavity and 10 inches high, with dovetail-shaped notches 7 inches deep that prevent clogging with mortar droppings.
 - b. Strips, not less than 3/4 inch thick and 10 inches high, with dimpled surface designed to catch mortar droppings and prevent weep holes from clogging with mortar.
 - c. Sheets or strips, full depth of cavity and installed to full height of cavity.

- d. Sheets or strips not less than 3/4 inch thick and installed to full height of cavity, with additional strips 4 inches high at weep holes and thick enough to fill entire depth of cavity and prevent weep holes from clogging with mortar.

2.13 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned. Verify suitability of cleaner with mortar tint used as specified elsewhere.
- B. Masonry Cleaner for existing masonry: As specified in Division 4 Masonry Restoration and Cleaning.

2.14 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 1. Do not use calcium chloride in mortar or grout.
 2. Use portland cement-lime mortar unless otherwise indicated.
 3. For exterior masonry, use portland cement-lime mortar.
 4. For reinforced masonry, use portland cement-lime mortar.
 5. Add cold-weather admixture (if used) at the same rate for all mortar; regardless of weather conditions to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
 1. For masonry below grade or in contact with earth, use Type M.
 2. For reinforced masonry, use Type S.
 3. For mortar parge coats, use Type S or Type N.
 4. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type S or M.
 5. For interior nonload-bearing partitions, Type O may be used instead of Type N.
- D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
 1. Pigments shall not exceed 10 percent of portland cement by weight.
 2. Mix to match Architect's sample.

3. Application: Use pigmented mortar for exposed mortar joints with the following units:
 - a. Clay face brick.
 - b. Cast-stone trim units.
 4. Pre- tinted mortar mixes shall be used in lieu of field mixed pigments.
- E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
1. Mix to match Architect's sample.
 2. Application: Use colored-aggregate mortar for exposed mortar joints with the following units:
 - a. Clay face brick.
 - b. Cast-stone trim units.
- F. Grout for Unit Masonry: Comply with ASTM C476.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
 2. Proportion grout in accordance with ASTM C476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
 3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C143/C143M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
 2. Verify that foundations are within tolerances specified.
 3. Verify that reinforcing dowels are properly placed.
 4. Verify that substrates are free of substances that impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Examine and cull masonry units that are damaged or that when installed will result in non-uniformity of the finished wall surface. Non-uniformities include excessive variation of color, shape, dimension or surface texture. Architect will make final determination as to acceptability of masonry units.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
- D. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- F. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.
- G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested according to ASTM C67. Allow units to absorb water so they are damp but not wet at time of laying.
- H. Dispose of runoff from cleaning operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.
- I. Concrete walls: Coordinate locations of dovetail slots for casting into concrete wall.
- J. Adjust masonry to provide 3/8" joint at each jamb of door frame opening, unless otherwise noted.
 - 1. Locations: At exterior door openings indicated in Door Schedule.

3.3 TOLERANCES

- A. Dimensions and Locations of Elements:
 - 1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
 - 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/4 inch.
 - 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/16 inch, with a maximum thickness limited to 7/16".
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/16 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/16 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in bond pattern indicated on Drawings; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 inches. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive

mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
 - 1. Install compressible filler in joint between top of partition and underside of structure above.
 - 2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
 - 3. Wedge nonload-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
 - 4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078443 "Joint Firestopping."

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow brick and CMUs as follows:
 - 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
 - 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
 - 3. Bed webs in mortar in grouted masonry, including starting course on footings.
 - 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
 - 5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.
- B. Lay solid masonry units and hollow brick with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
 - 1. At cavity walls, bevel beds away from cavity, to minimize mortar protrusions into cavity. As work progresses, trowel mortar fins protruding into cavity flat against the cavity face of the brick.
- C. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.

1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 2. Allow cleaned surfaces to dry before setting.
 3. Wet joint surfaces thoroughly before applying mortar.
 4. Rake out mortar joints for pointing with sealant.
- D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.
- F. Cut joints flush where indicated to receive waterproofing, cavity wall insulation, or air barriers unless otherwise indicated.

3.6 CAVITY WALLS

- A. Bond wythes of cavity walls together using one of the following methods:
1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 1.77 sq. ft. of wall area spaced not to exceed 16 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.
 - a. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) ties.
 - b. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable-type (two-piece-type) ties to allow for differential movement regardless of whether bed joints align.
 2. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.
 - a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
 - b. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) reinforcement with continuous horizontal wire in facing wythe attached to ties.
 - c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable-type (two-piece-type) reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align.
 3. Header Bonding: Provide masonry unit headers extending not less than 3 inches into each wythe. Space headers not more than 8 inches clear horizontally and 16 inches clear vertically.
 4. Masonry-Veneer Anchors: Comply with requirements for anchoring masonry veneers.
- B. Bond wythes of cavity walls together using bonding system indicated on Drawings.

- C. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
- D. Parge cavity face of backup wythe in a single coat approximately 3/8 inch thick. Trowel face of parge coat smooth.
- E. Installing Cavity Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.
 - 1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.
- F. Install cavity drainage material at all locations where throughwall flashing is indicated. Install full depth of cavity for a height of not less than 10" above flashing.
- G. Leave inspection openings at each course immediately above through-wall flashing and lintels by omitting one whole unit for every eight units laid horizontally. After wall cavity inspection and approval by the Architect, infill openings by inserting like units and properly filling head and bed joints and pointing as required for smooth, uniform appearance.
 - 1. Cavities that have excessive mortar build-up will be cleaned by removal of the veneer. Excessive mortar build-up will be determined by the Architect.

3.7 ANCHORED MASONRY VENEERS

- A. Anchor masonry veneers to wall framing and concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:
 - 1. Fasten screw-attached and seismic anchors through sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
 - 2. Embed tie sections, connector sections, and continuous wire in masonry joints.
 - 3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 - 4. Space anchors as indicated, but not more than 16 inches o.c. vertically and horizontally. Install additional anchors within 12 inches of openings and at intervals, not exceeding 24 inches, around perimeter.
- B. Provide not less than 2 inches of airspace between back of masonry veneer and face of sheathing and insulation, unless otherwise indicated on the Drawings.
 - 1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.8 MASONRY-JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
 - 1. Space reinforcement not more than 16 inches o.c.
 - 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
 - 3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.
 - a. Reinforcement above is in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.9 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:
 - 1. Provide an open space not less than 1 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 - 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
 - 3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.10 CONTROL AND EXPANSION JOINTS

- A. General: Install expansion joints in unit masonry and control joints in brick where indicated. Install control joints in CMU at 20'-0" on center maximum. Build-in related items as masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.
- B. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than 3/8 inch.
 - 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.
- C. Where masonry walls supported by elevated floor construction meet ground supported walls, control joints shall be installed.
- D. Install silicone sealant for all masonry expansion and control joints in accordance with Division 7 "Joint Sealants".

- E. Install vandal-resistant expansion joint covers or metal angles over compressible expansion joint material in accordance with Division 7 "Expansion Control" and the Drawings.

3.11 LINTELS

- A. Install steel lintels where indicated.
- B. Provide concrete or masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.
- C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.12 FLASHING, WEEP HOLES, AND CAVITY VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install cavity vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
 - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 - 2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches, and through inner wythe to within 1/2 inch of the interior face of wall in exposed masonry. Where interior face of wall is to receive furring or framing, carry flashing completely through inner wythe and turn flashing up approximately 2 inches on interior face.
 - 3. At masonry-veneer walls, extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under water-resistive barrier or air barrier, lapping at least 4 inches. Fasten upper edge of flexible flashing to sheathing through termination bar.
 - 4. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
 - 5. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
 - 6. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
 - 7. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.

- C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
- D. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.
 - 1. Use specified weep/cavity vent products to form weep holes.
 - 2. Space weep holes 24 inches o.c. unless otherwise indicated.
 - 3. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.
- E. Place pea gravel in cavities as soon as practical to a height equal to height of first course above top of flashing, but not less than 2 inches, to maintain drainage.
- F. Place cavity drainage material in cavities or airspace behind veneers to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.
- G. Install cavity vents in head joints in exterior wythes at spacing indicated. Use specified weep/cavity vent products to form cavity vents.
 - 1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.13 REINFORCED UNIT MASONRY

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 - 1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 - 2. Limit height of vertical grout pours to not more than 60 inches.

3.14 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform

tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

- B. Inspections: Special inspections according to Level B in TMS 402/ACI 530/ASCE 5.
 - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 - 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 - 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C67 for compressive strength.
- E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C140 for compressive strength.
- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C780.
- G. Grout Test (Compressive Strength): For each mix provided, according to ASTM C1019.

3.15 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.

5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
6. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.16 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 1. Crush masonry waste to less than 4 inches in each dimension.
 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 31 section "Earthwork".
 3. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.
- D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

SECTION 051200 - STRUCTURAL STEEL FRAMING**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Structural steel.
 - 2. Shrinkage-resistant grout.

1.3 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

1.4 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

- A. Product Data:
 - 1. Structural-steel materials.
 - 2. High-strength, bolt-nut-washer assemblies.
 - 3. Shear stud connectors.
 - 4. Anchor rods.
 - 5. Shrinkage-resistant grout.
- B. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Include embedment Drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.

4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
5. Identify members not to be shop primed.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installer and fabricator.
- B. Welding certificates.

1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU (Certified Building Fabricator).
- B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.
 1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8/D1.8M. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with applicable provisions of the following specifications and documents:
 1. ANSI/AISC 303.
 2. ANSI/AISC 360.
 3. RCSC's "Specification for Structural Joints Using High-Strength Bolts."
- B. Connection Design Information:

1. Option 1: Connection designs have been completed and connections indicated on the Drawings.

2.2 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A992/A992M.
- B. Channels, Angles: ASTM A36/A36M.
- C. Plate and Bar: ASTM A36/A36M.
- D. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade C structural tubing.
- E. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

- A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.
- B. Shear Stud Connectors: ASTM A108, AISI C-1015 through C-1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

2.4 ANCHOR RODS

- A. Headed Anchor Rods: ASTM F1554, Grade 36.
 1. Nuts: ASTM A563 heavy-hex carbon steel.
 2. Plate Washers: ASTM A36/A36M carbon steel.
 3. Washers: ASTM F436, Type 1, hardened carbon steel.
 4. Finish: Plain.
- B. Threaded Rods: ASTM A193, Grade B7.
 1. Nuts: ASTM A63 heavy-hex carbon steel.
 2. Washers: ASTM F436, Type 1, Hardened.
 3. Finish: Plain.

2.5 PRIMER

- A. Steel Primer:
 1. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- B. Galvanized-Steel Primer:
 1. Etching Cleaner: MPI#25, for galvanized steel.
 2. Galvanizing Repair Paint: ASTM A780/A780M.

2.6 SHRINKAGE-RESISTANT GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.7 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.
 - 1. Camber structural-steel members where indicated.
 - 2. Fabricate beams with rolling camber up.
 - 3. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing has been erected.
 - 4. Mark and match-mark materials for field assembly.
 - 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using automatic end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.
- F. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 - 2. Baseplate Holes: Cut, drill or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.8 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

2.9 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123/A123M.
 - 1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
 - 2. Galvanize loose lintels located in exterior walls.

2.10 SHOP PRIMING

- A. Shop prime steel surfaces, except the following:
 - 1. Galvanized surfaces.
- B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:
 - 1. SSPC-SP 2.
 - 2. SSPC-SP 3.
- C. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner or in accordance with SSPC-SP 16.
- D. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 - 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 - 1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.

1. Do not remove temporary shoring supporting composite deck construction and structural-steel framing until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.
- B. Baseplates and Bearing Plates: Clean masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 2. Weld plate washers to top of baseplate.
 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.
- C. Maintain erection tolerances of structural steel within ANSI/AISC 303.
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.
 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 2. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

3.5 REPAIR

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780/A780M.
- B. Touchup Painting:
 - 1. Immediately after erection, clean exposed areas where primer is damaged or missing, and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

3.6 SPECIAL INSPECTIONS

- A. Special Inspections will be performed by the Owner's Special Inspector.
- B. Verification and inspection of structural steel construction shall be in accordance with the 2018 North Carolina State Building Code and as follows:
- C. Inspections:
 - 1. Periodically inspect erected steel framing to verify member locations, spacing, bearing conditions and connection details.
 - 2. Bolted Connections: Inspect and test bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
 - 3. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.
 - a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at Special Inspector's option:
 - 1) Liquid Penetrant Inspection: ASTM E165/E165M.
 - 2) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - 3) Ultrasonic Inspection: ASTM E164.
 - 4) Radiographic Inspection: ASTM E94/E94M.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- E. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION 051200

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SECTION 052100 - STEEL JOIST FRAMING**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Double pitched LHSP special long-span joists.
 - 2. Steel joist accessories.

1.3 DEFINITIONS

- A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."
- B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.4 ACTION SUBMITTALS

- A. Shop Drawings:
 - 1. Include layout, designation, number, type, location, and spacing of joists.
 - 2. Include joining and anchorage details; bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.
 - 3. Indicate locations and details of bearing plates to be embedded in other construction.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Welding certificates.
- C. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications."
 - 1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

- B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle joists as recommended in SJI's "Specifications."
- B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.8 SEQUENCING

- A. Deliver steel bearing plates to be built into masonry construction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated on Drawings.
 - 1. Use ASD; data are given at service-load level.
 - 2. Design special joists to withstand design loads with live-load deflections no greater than the following:
 - a. Roof Joists: Total vertical deflection of 1/240 and live load/snow load deflection of 1/360 of the span or maximum total vertical deflection of 1-inch; whichever is less.

2.2 STEEL JOISTS

- A. Long-Span Steel Joist: Manufactured steel joists according to "Standard Specification for Longspan Steel Joists, LH-Series and Deep Longspan Steel Joists, DLH-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members; of joist type and end and top-chord arrangements as indicated on Drawings.
 - 1. Joist Type: LHSP special long-span steel joists.
 - 2. End Arrangement: As shown.
 - 3. Camber long-span steel joists according to SJI's "Specifications."
 - 4. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.3 PRIMERS

- A. Primer:
 - 1. SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

2.4 STEEL JOIST ACCESSORIES

- A. Bridging:

1. Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.
- B. Fabricate steel bearing plates from ASTM A36/A36M steel with integral anchorages of sizes and thicknesses indicated on Drawings, shop prime paint.
- C. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction.
 1. Extend ends to within 1/2 inch of finished wall surface unless otherwise indicated on Drawings.
- D. Welding Electrodes: Comply with AWS standards.
- E. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.5 CLEANING AND SHOP PAINTING

- A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.
- B. Apply one coat of shop primer to all joists and joist accessories to provide a continuous, dry paint film not less than 1 mil thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Do not install joists until supporting construction is in place and secured.
- B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written instructions, and requirements in this Section.
 1. Space, adjust, and align joists accurately in location before permanently fastening.
 2. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
- C. Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and

procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

- D. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 REPAIRS

A. Touchup Painting:

- 1. Immediately after installation, clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates and accessories.
 - a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
 - b. Apply a compatible primer of same type as primer used on adjacent surfaces.

3.4 SPECIAL INSPECTIONS

A. Special Inspections will be performed by the Owner's Special Inspector.

B. Verification and inspection of steel joist construction shall be in accordance with the 2018 North Carolina State Building Code and as follows:

C. Inspections:

- 1. Periodically inspect erected steel joist framing to verify member locations, spacing, bearing conditions and connection details.
- 2. Visually inspect field welds according to AWS D1.1/D1.1M.
- 3. In addition to visual inspection, test field welds according to AWS D1.1/D1.1M and the following procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E165/E165M.
 - b. Magnetic Particle Inspection: ASTM E709.
 - c. Ultrasonic Testing: ASTM E164.
 - d. Radiographic Testing: ASTM E94.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

E. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION 052100

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Type B roof deck.
 - 2. Type N roof deck.
 - 3. Type C non-composite form deck.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Roof deck.
 - 2. Non-composite form deck.
- B. Shop Drawings:
 - 1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
 - 1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

PART 2 - PRODUCTS**2.1 PERFORMANCE REQUIREMENTS**

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 ROOF DECK

- A. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
 - 1. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33, G60 zinc coating.
 - 2. Deck Profile: Type B or Type N, as indicated.
 - 3. Profile Depth: 1-1/2 inches or 3 inches, as indicated.
 - 4. Design Uncoated-Steel Thickness: As indicated.
 - 5. Span Condition: Triple span or more.
 - 6. Side Laps: Overlapped.

2.3 NON-COMPOSITE FORM DECK

- A. Non-composite Form Deck: Fabricate ribbed-steel sheet non-composite form-deck panels to comply with "SDI Specifications and Commentary for Non-composite Steel Form Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
 - 1. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 50, G60 zinc coating.
 - 2. Deck Profile: Type C.
 - 3. Profile Depth: 1-1/2 inches.
 - 4. Design Uncoated-Steel Thickness: As indicated.
 - 5. Span Condition: Triple span or more.
 - 6. Side Laps: Overlapped.

2.4 ACCESSORIES

- A. Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

- D. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- E. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- F. Galvanizing Repair Paint: ASTM A780/A780M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck with written approval of Structural Engineer.

3.3 INSTALLATION OF ROOF DECK

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
 - 1. Weld Diameter: 5/8 inch, nominal.

2. Weld Spacing: Weld edge and interior ribs of deck units with weld spacing as indicated.
- B. Fasten roof-deck panels to light gauge steel supporting members and as follows:
 1. Mechanically fasten with self-drilling, No. 12 diameter or larger, carbon-steel screws.
 2. Fastener Spacing: Screw edge and interior ribs of deck units with fastener spacing as indicated.
- C. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals indicated and as follows:
 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
- D. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 1. End Joints: Lapped 2 inches minimum.
- E. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld flanges to top of deck. Space welds not more than 12 inches apart with at least one weld at each corner.
 1. Install reinforcing channels or zees in ribs to span between supports and weld.
- F. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.
 1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

3.4 INSTALLATION OF FLOOR DECK

- A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
 1. Weld Diameter: 5/8 inch, nominal.
 2. Weld Spacing: Space and locate welds as indicated.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 36 inches, and as follows:
 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 1. End Joints: Butted.
- D. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.5 REPAIR

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

3.6 SPECIAL INSPECTIONS

- A. Special Inspections will be performed by the Owner's Special Inspector.
- B. Verification and inspection of steel deck construction shall be in accordance with the 2018 North Carolina State Building Code and as follows:
- C. Inspections:
 - 1. Periodically inspect installed steel decking to verify deck gage, bearing, support and side lap fastening.
 - 2. Field welds will be subject to inspection per AWS D1.3.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- E. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION 053100

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SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Exterior non-load-bearing wall framing.
 - 2. Exterior ceiling joist, soffit and fascia framing.
 - 3. All framing designated as "CFMF" on structural drawings.
 - 4. All framing designated as "CFSF-S" on architectural drawings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of cold-formed steel framing product and accessory.

1.4 QUALITY ASSURANCE

- A. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."
 - 1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: 50.
2. Coating: G60.

- B. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: 50.
2. Coating: G90.

2.2 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 43 mil.
2. Minimum Flange Width: 1-5/8 inches.

- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 43 mil.
2. Flange Width: 1-1/4 inches.

- C. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

2.3 EXTERIOR CEILING JOIST, SOFFIT AND FASCIA FRAMING

- A. Members: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 43 mil.
2. Minimum Flange Width: 1-5/8 inches, minimum.

2.4 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.

6. Foundation clips.
7. Stud kickers, knee braces, and girts.
8. Hole reinforcing plates.
9. Backer plates.

2.5 ANCHORS, CLIPS, AND FASTENERS

- A. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

2.6 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A 780.

2.7 FABRICATION

- A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed metal framing members by screw fastening. Wire tying of framing members is not permitted.
 - a. Locate mechanical fasteners and install according to Contract Drawings, with screw penetrating joined members by not less than three exposed screw threads.
4. Fasten other materials to cold-formed metal framing by screw fastening, according to Contract Drawings.

- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed metal framing members by screw fastening. Wire tying of framing members is not permitted.
 - a. Locate mechanical fasteners and install according to Contract Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- H. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
- J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.3 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to bottom track, unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: 16 inches, maximum.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Connect vertical deflection clips to bypassing studs and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced in rows indicated on Contract Drawings but not more than 48 inches apart. Fasten at each stud intersection.
 - 1. Bridging: Cold-rolled steel channel, mechanically fastened to webs of punched studs.
 - 2. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.4 EXTERIOR CEILING JOIST, SOFFIT AND FASCIA INSTALLATION

- A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Contract Drawings.
- B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
 - 1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.
 - 2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Contract Drawings.

- C. Space joists not more than 2 inches from abutting walls, and as follows:
 - 1. Joist Spacing: 16 inches, maximum.
- D. Install bridging at intervals indicated on Contract Drawings. Fasten bridging at each joist intersection as follows:
 - 1. Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
- E. Secure joists to load-bearing walls or supporting framing to prevent lateral movement of bottom flange.
- F. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.5 SPECIAL INSPECTIONS

- A. Special Inspections will be performed by the Owner's Special Inspector.
- B. Verification and inspection of cold-formed metal framing shall be in accordance with the 2018 North Carolina State Building Code and as follows:
- C. Inspections:
 - 1. Periodically inspect installed cold-formed metal framing to verify member sizes, gages, spacing and connection details.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- E. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 054400 - COLD-FORMED METAL TRUSSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Roof trusses, stud framing for outriggers, truss blocking panels.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Cold-formed steel truss materials, stud framing for outriggers and truss blocking panels.
- B. Shop Drawings:
 - 1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel trusses; fabrication; and fastening and anchorage details, including mechanical fasteners.
 - 2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
- C. Delegated-Design Submittal: For cold-formed steel trusses.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each listed product, for tests performed by a qualified testing agency.
 - 1. Steel sheet.
 - 2. Mechanical fasteners.
 - 3. Miscellaneous structural clips and accessories.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

- B. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer to design cold-formed steel trusses.
- B. Structural Performance: Provide cold-formed steel trusses capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: As indicated on Drawings.
 - 2. Deflection Limits: Design trusses to withstand design loads without deflections greater than the following:
 - a. Roof Trusses: Total load vertical deflection of 1/240 of the span, live load deflection of 1/360 of the span, and 1" maximum.
 - 3. Design trusses to provide for movement of truss members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 100 deg F.
- C. Cold-Formed Steel Truss Standards: Unless more stringent requirements are indicated, trusses shall comply with the following:
 - 1. Floor and Roof Systems: AISI S210.
 - 2. Lateral Design: AISI S213.
 - 3. Roof Trusses: AISI S214.
- D. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.2 COLD-FORMED STEEL TRUSS MATERIALS

- A. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
 - 1. Grade: ST50H.
 - 2. Coating: G60.

2.3 ROOF TRUSSES

- A. Roof Truss Members: Manufacturer's standard C-shaped steel sections.
 - 1. Connecting Flange Width: 1-5/8 inches, minimum at top and bottom chords.
 - 2. Minimum Base-Metal Thickness: 0.0428 inch.

2.4 TRUSS ACCESSORIES

- A. Fabricate steel-truss accessories from steel sheet, ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for truss members.
- B. Provide accessories of manufacturer's standard thickness and configuration unless otherwise indicated.

2.5 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process in accordance with ASTM A123/A123M.
- B. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.
- C. Welding Electrodes: Comply with AWS standards.

2.6 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A780.
- B. Shims: Load-bearing, high-density multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as truss members supported by shims.

2.7 FABRICATION

- A. Fabricate cold-formed steel trusses and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate trusses using jigs or templates.
 - 2. Cut truss members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed steel truss members by screw fastening.
 - 4. Fasten other materials to cold-formed steel trusses by screw fastening.

- B. Reinforce, stiffen, and brace trusses to withstand handling, delivery, and erection stresses. Lift fabricated trusses by means that prevent damage or permanent distortion.
- C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet (1:960) and as follows:
 - 1. Spacing: Space individual truss members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed steel truss to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, conditions, and abutting trusses and framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install bridge, and brace cold-formed steel trusses according to AISI S200, AISI S202, AISI S214, and manufacturer's written instructions unless more stringent requirements are indicated.
 - 1. Anchor trusses securely at all bearing points.
 - 2. Install continuous bridging and permanently brace trusses as indicated on Shop Drawings and designed according to CFSEI's Technical Note 551e, "Design Guide: Permanent Bracing of Cold-Formed Steel Trusses."
- B. Install cold-formed steel trusses and accessories true to line and location, and with connections securely fastened.
 - 1. Erect trusses with plane of truss webs plumb and parallel to each other. Align and accurately position trusses at required spacings.
 - 2. Erect trusses without damaging truss members or connections.
 - 3. Fasten cold-formed steel trusses to supporting continuous steel embed plates in masonry walls and to supporting steel framing by welding hold down anchors at all truss bearings. Hold down anchors shall be provided by truss manufacturer.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
- C. Install temporary bracing and supports to secure trusses and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire

integrated supporting structure has been completed and permanent connections to trusses are secured.

- D. Truss Spacing: As indicated on Drawings.
- E. Do not alter, cut, or remove truss members or connections of trusses.

3.3 ERECTION TOLERANCES

- A. Install cold-formed steel trusses level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
 - 1. Space individual trusses no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 REPAIR

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel trusses with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

3.5 SPECIAL INSPECTIONS

- A. Special Inspections will be performed by the Owner's Special Inspector.
- B. Verification and inspection of cold-formed metal truss construction shall be in accordance with the 2018 North Carolina State Building Code and as follows:
- C. Inspections:
 - 1. Periodically inspect installed cold-formed metal trusses to verify member size, spacing, bearing conditions, hold down anchors and bridging of top chord, bottom chord and web members as required by truss shop drawings.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- E. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.6 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel trusses are without damage or deterioration at time of Substantial Completion.

END OF SECTION 054400

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Steel framing and supports for countertops.
2. Steel tube reinforcement for low partitions.
3. Steel framing and supports for mechanical and electrical equipment.
4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
5. Slotted channel framing.
6. Shelf angles.
7. Metal bollards.
8. Metal downspout boots.
9. Loose bearing and leveling plates for applications where they are not specified in other Sections.

- B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

- C. Related Requirements:

1. Section 042000 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves,

concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Fasteners.
3. Shop primers.
4. Shrinkage-resisting grout.
5. Slotted channel framing.
6. Metal bollards.
7. Metal downspout boots.
8. Abrasive metal nosing treads

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:

1. Steel framing and supports for countertops.
2. Steel tube reinforcement for low partitions.
3. Steel framing and supports for mechanical and electrical equipment.
4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
5. Shelf angles.
6. Metal bollards.
7. Loose steel lintels.
8. Miscellaneous steel trim including steel angle corner guards steel edging.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.
- B. Mill Certificates: Signed by stainless steel manufacturers, certifying that products furnished comply with requirements.
- C. Welding certificates.
- D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- E. Research Reports: For post-installed anchors.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 304 .
- D. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 304 .
- E. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.
- F. Rolled-Stainless Steel Floor Plate: ASTM A793.
- G. Abrasive-Surface Floor Plate: Steel plate with abrasive material metallurgically bonded to steel.
 1. Source Limitations: Obtain floor plate from single source from single manufacturer.
- H. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.
- I. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.
- J. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.
- K. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.
- L. Nickel Silver Extrusions: ASTM B151/B151M, Alloy UNS No. C74500.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless steel fasteners for fastening aluminum or stainless steel.
 - 2. Provide bronze fasteners for fastening bronze.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.
- C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, heavy-hex carbon-steel nuts; and where indicated, flat washers.
- D. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 1.
- E. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- F. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.
- G. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.
- H. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting" or Section 099123 "Interior Painting."
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- D. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- G. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- H. Concrete: Comply with requirements in the Structural Drawings for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts for units installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.
- D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.7 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
 - 1. Provide mitered and welded units at corners.
 - 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Galvanize shelf angles located in exterior walls.
- D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.8 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 - 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Galvanize and prime miscellaneous steel trim.
- D. Prime exterior miscellaneous steel trim with zinc rich primer.

2.9 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 40 steel pipe.
 - 1. Cap bollards with 1/4-inch-thick, steel plate with domed top.
- B. Prime steel bollards with zinc-rich primer.

2.10 METAL DOWNSPOUT BOOTS

- A. Source Limitations: Obtain downspout boots from single source from single manufacturer.
- B. Provide downspout boots made from cast iron in heights indicated with inlets of size and shape to suit downspouts. Provide units with flanges and holes for countersunk anchor bolts.
 - 1. Outlet: Vertical, to discharge into pipe, unless otherwise indicated.
- C. Prime cast-iron downspout boots with zinc-rich primer.

2.11 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize bearing and leveling plates.

2.12 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls.

2.13 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.14 GENERAL FINISH REQUIREMENTS

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.15 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete or masonry, or unless otherwise indicated.
 - 1. Shop prime with universal shop primer unless zinc-rich primer is indicated.
- D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.16 ALUMINUM FINISHES

- A. As Fabricated Finish – AA-M12.
- B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C2241.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
 - 1. Cast Aluminum: Heavy coat of bituminous paint.
 - 2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor shelf angles securely to existing construction with expansion anchors, anchor bolts, or through bolts.
- C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.
- D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installation of Bearing and Leveling Plates" Article.
 1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLATION OF METAL BOLLARDS

- A. Fill metal-capped bollards solidly with minimum 3,000 psi concrete and allow concrete to cure seven days before installing.
 1. Do not fill removable bollards with concrete.
- B. Anchor bollards in place with minimum 3,000 psi concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

3.4 INSTALLATION OF PIPE GUARDS

- A. Provide pipe guards at exposed vertical pipes in at locations indicated on Drawings where not protected by curbs or other barriers. Install by bolting to wall or column with expansion anchors. Provide four 3/4-inch bolts at each pipe guard. Mount pipe guards with top edge 26 inches above driving surface.

3.5 INSTALLATION OF NOSINGS, TREADS, AND THRESHOLDS

- A. Center nosings on tread widths unless otherwise indicated.
- B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.
- C. Seal thresholds exposed to exterior with elastomeric sealant complying with Section 079200 "Joint Sealants" to provide a watertight installation.

3.6 INSTALLATION OF BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with shrinkage-resistant grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.7 REPAIRS

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055000

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SECTION 055113 - METAL PAN STAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Preassembled steel stairs with concrete-filled landings and treads.
- B. Related Sections:
 - 1. Section 055213 "Pipe and Tube Railings".

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal stairs, railings, and guards.
 - 1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, blocking for attachment of wall-mounted handrails, and items with integral anchors, that are to be embedded in concrete or masonry.
 - 2. Deliver such items to Project site in time for installation.
- C. Coordinate locations of hanger rods and struts with other work so they do not encroach on required stair width and are within fire-resistance-rated stair enclosure.
- D. Schedule installation of railings and guards so wall attachments are made only to completed walls.
 - 1. Do not support railings and guards temporarily by any means that do not satisfy structural performance requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: For metal pan stairs and the following:
 - 1. Shop primer products.
 - 2. Grout.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.
2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
3. Include plan at each level.
4. Indicate locations of anchors, weld plates, and blocking for attachment of wall-mounted handrails.

C. Delegated-Design Submittal: For stairs, railings and guards,, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the State in which Project is located.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification.
1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.
 2. Protect steel members and packaged materials from corrosion and deterioration.
 3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.
 - a. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design stairs, railings and guards,, including attachment to building construction.
- B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Uniform Load: 100 lbf/sq. ft.
 - 2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Stair Framing: Capable of withstanding stresses resulting from railing and guard loads in addition to loads specified above.
 - 5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.
 - 6. Seismic Performance of Stairs: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - a. Component Importance Factor: As indicated on drawings.

2.2 METALS

- A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Steel Tubing for Railings and Guards: ASTM A500/A500M (cold formed).
 - 1. Provide galvanized finish for exterior installations and where indicated.
- D. Steel Pipe for Railings and Guards: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
 - 1. Provide galvanized finish for exterior installations and where indicated.
- E. Uncoated, Cold-Rolled Steel Sheet: ASTM A1008/A1008M, either commercial steel, Type B, or structural steel, Grade 25, unless another grade is required by design loads; exposed.
- F. Galvanized-Steel Sheet: ASTM A653/A653M, G90 coating, either commercial steel, Type B, or structural steel, Grade 33, unless another grade is required by design loads.
- G. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.
- H. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

2.3 FASTENERS

- A. Fasteners for Anchoring Railings and Guards to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings and guards to other types of construction indicated and capable of withstanding design loads.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
 - 1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for exterior stairs, stairs indicated to be galvanized, or stairs indicated to be shop primed with zinc-rich primer.
- D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Electrodes: Comply with AWS requirements.
- B. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" that comply with Section 099600 "High Performance Coatings".
- C. For galvanized reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.5 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, railings and guards, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 - 1. Join components by welding unless otherwise indicated.
 - 2. Use connections that maintain structural value of joined pieces.
- B. Assemble stairs, railings, and guards in shop to greatest extent possible.
 - 1. Disassemble units only as necessary for shipping and handling limitations.
 - 2. Clearly mark units for reassembly and coordinated installation.

- C. Cut, drill, and punch metals cleanly and accurately.
 - 1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
 - 2. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Weld exposed corners and seams continuously unless otherwise indicated.
 - 5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish # 1 – No evidence of welded joint.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.
 - 1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
 - 2. Locate joints where least conspicuous.
 - 3. Fabricate joints that will be exposed to weather in a manner to exclude water.
 - 4. Provide weep holes where water may accumulate internally.

2.6 FABRICATION OF STEEL-FRAMED STAIRS

- A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Commercial Class, unless more stringent requirements are indicated.
- B. Stair Framing:
 - 1. Fabricate stringers of steel plates, steel channels, or steel rectangular tubes as indicated on Drawings.
 - a. Stringer Size: As indicated on Drawings.
 - b. Provide closures for exposed ends of channel and rectangular tube stringers.
 - c. Finish: Shop Primed.
 - 2. Construct platforms of steel plate, channel, or rectangular tube headers and miscellaneous framing members as required to comply with "Performance Requirements" Article and as indicated on Drawings.
 - a. Provide closures for exposed ends of channel and rectangular tube framing.
 - b. Finish: Shop Primed.

3. Weld stringers to headers; weld framing members to stringers and headers.
 4. Where stairs are enclosed by gypsum board or gypsum board shaft-wall assemblies, provide hanger rods or struts to support landings from floor construction above or below.
 - a. Locate hanger rods and struts where they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.
 5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
- C. Metal Pan Stairs: Form risers, subreads pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than 0.067 inch.
1. Fabricate treads and landing subplatforms of exterior stairs so finished walking surfaces slope to drain.
 2. Steel Sheet: Uncoated, cold-rolled steel sheet.
 3. Steel Sheet: Galvanized-steel sheet, where indicated.
 4. Directly weld metal pans to stringers; locate welds on top of subreads where they will be concealed by concrete fill. Do not weld risers to stringers.
 5. Attach risers and subreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
 6. Shape metal pans to include nosing integral with riser.
 7. At Contractor's option, provide stair assemblies with metal pan subreads filled with reinforced concrete during fabrication.
 8. Provide subplatforms of configuration indicated or, if not indicated, the same as subreads. Weld subplatforms to platform framing.
 - a. Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits.

2.7 FINISHES

- A. Finish metal stairs after assembly.
- B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
 1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
 2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- C. Preparation for Shop Priming: Prepare uncoated, ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
- D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.
 - 1. For wall-mounted railings, verify locations of concealed reinforcement within gypsum board and plaster assemblies.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF METAL PAN STAIRS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.
 - 1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
 - 1. Grouted Baseplates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates.
 - a. Clean bottom surface of plates.
 - b. Set plates for structural members on wedges, shims, or setting nuts.
 - c. Tighten anchor bolts after supported members have been positioned and plumbed.
 - d. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - e. Promptly pack grout solidly between bearing surfaces and plates so no voids remain.
 - 1) Neatly finish exposed surfaces; protect grout and allow to cure.
 - 2) Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Fit exposed connections accurately together to form hairline joints.
 - 1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.

2. Grind and smooth welds. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
3. Comply with requirements for welding in "Fabrication, General" Article.
4. Place and finish concrete fill for treads and platforms to comply with Section 033000 "Cast-In-Place Concrete."
 - a. Install abrasive nosings with anchors fully embedded in concrete.
 - b. Center nosings on tread width.

3.3 REPAIR

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055113

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Steel railings.
- B. Related Requirements:
 - 1. Section 055113 "Metal Pan Stairs" for steel tube railings associated with metal pan stairs.

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

- A. Product Data:
 - 1. Fasteners.
 - 2. Post-installed anchors.
 - 3. Handrail brackets.
 - 4. Shop primer.
 - 5. Intermediate coats and topcoats.
 - 6. Bituminous paint.
 - 7. Nonshrink, nonmetallic grout.
 - 8. Metal finishes.
 - 9. Paint products.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

- C. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For delegated-design professional engineer .
- B. Welding certificates.
- C. Product Test Reports: For tests on railings performed by a qualified testing agency, in accordance with ASTM E894 and ASTM E935.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces of railings from damage by applying a strippable, temporary protective covering before shipping.

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of **50 lbf/ ft.** applied in any direction.
 - b. Concentrated load of **250 lbf** applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:
 - a. Concentrated load of **50 lbf** applied horizontally on an area of **1 sq. ft.**
 - b. Infill load and other loads need not be assumed to act concurrently.
3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - a. a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
 1. Provide one piece cast iron hand rail wall mounting brackets. Brackets to be fabricated with 2 3/4 inch diameter round wall plate with holes for exposed fasteners and rounded rail support arm. Bracket to have radius rail seat for welded attachment of rail. Bracket to hold rail center 2 1/2 inches from wall. Acceptable products include but are not limited to model 382 by Julius Blum, Inc.

2.3 STEEL RAILINGS

- A. Source Limitations: Obtain each type of railing from single source from single manufacturer.
- B. Tubing: ASTM A500/A500M (cold formed) .
- C. Pipe: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

2.4 FASTENERS

- A. Fastener Materials:
 1. Ungalvanized-Steel Railing Components: Plated steel fasteners complying with **ASTM F1941**, Class Fe/Zn 5 for zinc coating.
 2. Hot-Dip Galvanized Railing Components: Type 304 stainless steel or hot-dip zinc-coated steel fasteners complying with ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.
 3. Finish exposed fasteners to match appearance, including color and texture, of railings.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction and capable of withstanding design loads.
- C. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
- D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193.
 1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

2.5 MISCELLANEOUS MATERIALS

- A. Handrail Brackets: Cast iron center of handrail 2-1/4 inches from face of railing or wall.
- B. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.
- C. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint, complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- E. Shop Primers: Provide primers that comply with Section 099600 "High-Performance Coatings."
- F. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- G. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- H. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- I. Intermediate Coats and Topcoats: Provide products that comply with Section 099600 "High-Performance Coatings."
- J. Bituminous Paint: Cold-applied asphalt emulsion, complying with ASTM D1187/D1187M.
- K. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.6 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.
 - 1. Clearly mark units for reassembly and coordinated installation.
 - 2. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately.
 - 1. Remove burrs and ease edges to a radius of approximately **1/32 inch** unless otherwise indicated.
 - 2. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that are exposed to weather in a manner that excludes water.
 - 1. Provide weep holes where water may accumulate.
 - 2. Locate weep holes in inconspicuous locations.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
 - 4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 welds; ornamental quality with no evidence of a welded joint
- I. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.
- J. Form changes in direction as follows:
 - 1. As detailed.
 - 2. By bending or .
 - 3. By radius bends of radius indicated or .
 - 4. By bending to smallest radius that will not result in distortion of railing member.
- K. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- L. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.

- M. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is **1/4 inch** or less.
- N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
 - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work.
 - 1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
 - 2. Coordinate anchorage devices with supporting structure.
- P. For railing posts set in concrete, provide stainless steel sleeves not less than **6 inches** long with inside dimensions not less than **1/2 inch** greater than outside dimensions of post, with metal plate forming bottom closure.
- Q. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.7 STEEL AND IRON FINISHES

- A. Galvanized Railings:
 - 1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
 - 2. Comply with ASTM A123/A123M for hot-dip galvanized railings.
 - 3. Comply with ASTM A153/A153M for hot-dip galvanized hardware.
 - 4. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
 - 5. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner and as follows.
 - 1. Comply with SSPC-SP 16.
- D. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, hot-dip galvanize anchors to be embedded in exterior concrete or masonry.
- E. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with requirements indicated below:

1. Railings Indicated To Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3.
- F. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1 for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
1. Shop prime uncoated railings with universal shop primer unless primers specified in Section 099600 "High-Performance Coatings" are indicated.
- G. Shop-Painted Finish: Comply with Section 099600 "High-Performance Coatings."
1. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

- A. Perform cutting, drilling, and fitting required for installing railings.
1. Fit exposed connections together to form tight, hairline joints.
 2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
 3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
 4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 5. Set posts plumb within a tolerance of **1/16 inch in 3 feet**.
 6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed **1/4 inch in 12 feet**.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- C. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

- A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article, whether welding is performed in the shop or in the field.
- B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve, extending **2 inches** beyond joint on either side; fasten internal sleeve securely to one side; and locate joint within **6 inches** of post.

3.4 ANCHORING POSTS

- A. Use stainless steel pipe sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Form or core-drill holes not less than **5 inches** deep and **3/4 inch** larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
- C. Leave anchorage joint exposed with anchoring material flush with adjacent surface.

3.5 ATTACHING RAILINGS

- A. Attach handrails to walls with wall brackets. Provide brackets with **1-1/2-inch** clearance from inside face of handrail and finished wall surface.
 - 1. Use type of bracket with predrilled hole for exposed bolt anchorage.
 - 2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

3.6 REPAIR

- A. Touchup Painting:
 - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum **2.0-mil** dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in

3.7 CLEANING

- A. Clean by washing thoroughly with clean water and soap and rinsing with clean water.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M.

3.8 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period, so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 055213

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SECTION 055313 - BAR GRATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal bar gratings.
 - 2. Grating frames and supports.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. Clips and anchorage devices for gratings.
 - 2. Paint products.
- B. Shop Drawings:
 - 1. Include plans, sections, and attachment details.
 - 2. Signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Delegated Design Submittals: For gratings, including manufacturers' published load tables and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.
- B. Certificates:
 - 1. Welding certificates.
- C. Delegated design engineer qualifications.

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Delegated Design Engineer: A professional engineer who is legally qualified to practice in state where Project is located and who is experienced in providing engineering services of the type indicated.
2. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:
 - a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - b. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.6 FIELD CONDITIONS

- ### A. Field Measurements: Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- #### A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. All American Grating.
 2. BarnettBates Corporation.
 3. Borden Metal Products (Canada) Limited.
 4. Fisher & Ludlow; a NUCOR Company.
 5. Grating Pacific, Inc.
 6. Grupo Metelmex, S.A. de C.V.
 7. Harsco Industrial IKG, a division of Harsco Corporation.
 8. MLP Steel Company; Laurel Steel Products Division.
 9. Neenah Foundry Company.
 10. Ohio Gratings, Inc.
 11. Ross Technology Company.
 12. Seidelhuber Metal Products; Brodhead Steel.

2.2 PERFORMANCE REQUIREMENTS

- #### A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design gratings.
- #### B. Structural Performance: Gratings to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
1. Walkways and Elevated Platforms Other Than Exits: Uniform load of 60 lbf/sq. ft.
 2. Limit deflection to L/360 or 1/4 inch, whichever is less.

2.3 METAL BAR GRATINGS

- A. Metal Bar Grating Standards: Comply with NAAMM MBG 531.
- B. Pressure-Locked Steel Grating: Fabricated by pressing rectangular flush-top crossbars into slotted bearing bars or swaging crossbars between bearing bars.
 - 1. Bearing Bar Spacing: As selected by the Architect from the manufacturer's full range.
 - 2. Bearing Bar Depth: As required to comply with structural performance requirements.
 - 3. Bearing Bar Thickness: As required to comply with structural performance requirements.
 - 4. Crossbar Spacing: As selected by the Architect from the manufacturer's full range.
 - 5. Traffic Surface: Applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy-resin adhesive, unless otherwise selected by the Architect.
 - 6. Steel Finish: Hot-dip galvanized with a coating weight of not less than 1.8 oz./sq. ft. of coated surface.

2.4 GRATING FRAMES AND SUPPORTS

- A. Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.
 - 1. Unless otherwise indicated, fabricate from same basic metal as gratings.
 - 2. Equip units indicated to be cast into concrete or built into masonry with integrally welded anchors. Unless otherwise indicated, space anchors 24 inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches wide by 1/4 inch thick by 8 inches long.
- B. Galvanize steel frames and supports in the following locations:
 - 1. Exterior.

2.5 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563, and, where indicated, flat washers.
- C. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, nuts, and, where indicated, flat washers; ASTM F593 for bolts and ASTM F594 for nuts, Alloy Group 1.
- D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563, and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

- E. Post-Installed Anchors: Torque-controlled expansion or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.
 - 1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

2.6 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting."
- B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.7 FERROUS METALS

- A. Steel Bars for Bar Gratings: ASTM A36/A36M or steel strip, ASTM A1011/A1011M or ASTM A1018/A1018M.
- B. Wire Rod for Bar Grating Crossbars: ASTM A510/A510M.
- C. Uncoated Steel Sheet: ASTM A1011/A1011M, structural steel, Grade 30.
- D. Galvanized-Steel Sheet: ASTM A653/A653M, structural quality, Grade 33, with G90 coating.

2.8 FABRICATION

- A. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.
- D. Fit exposed connections accurately together to form hairline joints.
- E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.

1. Fabricate toeplates to fit grating units and weld to units in shop unless otherwise indicated.
 2. Fabricate toeplates for attaching in the field.
 3. Toeplate Height: 4 inches unless otherwise indicated.
- F. Removable Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports.
1. Provide no fewer than four weld lugs for each grating section containing rectangular bearing bars 3/16 inch or less in thickness and spaced less than 15/16 inch o.c., with each lug shop welded to three or more bearing bars. Interrupt intermediate bearing bars as necessary for fasteners securing grating to supports.
 2. Furnish threaded bolts with nuts and washers for securing grating to supports.
 3. Furnish self-drilling fasteners with washers for securing grating to supports.
 4. Furnish galvanized malleable-iron flange clamp with galvanized bolt for securing grating to supports. Furnish as a system designed to be installed from above grating by one person.
- G. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.
1. Edge-band openings in grating that interrupt four or more bearing bars with bars of same size and material as bearing bars.
- H. Do not notch bearing bars at supports to maintain elevation.

2.9 STEEL FINISHES

- A. Finish gratings, frames, and supports after assembly.
- B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.
- D. Fit exposed connections accurately together to form hairline joints.
- E. Attach toeplates to gratings by welding at locations indicated.

3.2 INSTALLATION OF METAL BAR GRATINGS

- A. Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.
- B. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.
- C. Attach nonremovable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.

3.3 REPAIR

- A. Repair of Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055313

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Framing with dimension lumber.
2. Rooftop equipment bases and support curbs.
3. Wood blocking and nailers.
4. Plywood backing panels.
5. Roof Substrate

- B. Related Requirements:

1. Division 06 Section "Rough Carpentry for Roofing" for wood blocking, nailers, etc. for roofing.
2. Division 06 Section "Sheathing" for wall sheathing and roof sheathing.
3. Exposed Framing: Framing not concealed by other construction.
4. OSB: Oriented Strand Board
5. Timber: Lumber of 5 inches nominal size or greater in least dimension.

1.3 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.
- C. Exposed Framing: Framing not concealed by other construction.
- D. OSB: Oriented strand board.
- E. Timber: Lumber of 5 inches nominal size or greater in least dimension.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Fastener Patterns: Full-size templates for fasteners in exposed framing.

1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- B. Evaluation Reports: For the following, from ICC-ES:
1. Wood-preservative-treated wood.
 2. Fire-retardant-treated wood.
 3. Engineered wood products.
 4. Shear panels.
 5. Power-driven fasteners.
 6. Post-installed anchors.
 7. Metal framing anchors.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.
- B. Certified Wood: Provide an invoice including vendor's chain-of-custody number, product cost, and entity being invoiced.
- C. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
- B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.
- C. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
 - 1. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 - 2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing members that are less than **18 inches** above the ground in crawlspaces or unexcavated areas.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than **10.5 feet** beyond the centerline of the burners at any time during the test.
 1. Treatment shall not promote corrosion of metal fasteners.
 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
- C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. Application: Treat items indicated on Drawings, and the following:
 1. Plywood Sheathing
 2. Concealed blocking.
 3. Roof construction.
 4. Plywood backing panels.

2.4 DIMENSION LUMBER FRAMING

- A. Joists, Rafters, and Other Framing Not Listed Above: No. 2 grade.
 1. Species:
 - a. Southern pine; SPIB.
 - b. Western Woods; WCLIB or WWPA.

2.5 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Rooftop equipment bases and support curbs.
 - 4. Furring.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of any of the following species:
 - 1. Mixed southern pine or southern pine; SPIB.
 - 2. Western woods; WCLIB or WWPA.
- C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.6 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: FRT Plywood, C-D Plugged, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.7 FASTENERS

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.
 - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

2.8 ROOF SUBSTRATE

- A. Plywood, DOC PS 1, Exterior, A-C, fire retardant treated, in thickness of 3/4-inch (19-mm) nominal thickness.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- C. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- E. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- F. Do not splice structural members between supports unless otherwise indicated.
- G. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
- H. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than **96 inches** o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
 - 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than **96 inches** o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and **2-inch nominal** thickness.
 - 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than **100 sq. ft.** and to solidly fill space below partitions.
- I. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- J. Comply with AWPAC M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.

- K. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

- 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).

- L. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.3 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

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SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Wall sheathing.
 - 2. Sheathing joint and penetration treatment.
- B. Related Requirements:
 - 1. Section 061000 "Rough Carpentry" for plywood backing panels.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site .
 - 1. Review air-barrier and water-resistant glass-mat gypsum sheathing requirements and installation, special details, transitions, mockups, air-leakage testing, protection, and work scheduling that covers air-barrier and water-resistant glass-mat gypsum sheathing.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
 - 3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5516.
 - 4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - 5. For air-barrier and water-resistant glass-mat gypsum sheathing, include manufacturer's technical data and tested physical and performance properties of products.

B. Shop Drawings: For air-barrier and water-resistant glass-mat gypsum sheathing assemblies.

1. Show locations and extent of sheathing, accessories, and assemblies specific to Project conditions.
2. Include details for sheathing joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
3. Include details of interfaces with other materials that form part of air barrier.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each air-barrier and water-resistant glass-mat gypsum sheathing assembly, indicating compliance with specified requirements, for tests performed by a qualified testing agency.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications:

1. For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.
2. For testing and inspecting agency providing tests and inspections related to air-barrier and water-resistant glass-mat gypsum sheathing: an independent agency, qualified according to ASTM E329 for testing indicated, and certified by Air Barrier Association of America, Inc.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: As tested according to ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 WOOD PANEL PRODUCTS

- A. Emissions: Products shall meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- C. Factory mark panels to indicate compliance with applicable standard.

2.3 PRESERVATIVE-TREATED PLYWOOD

- A. Preservative Treatment by Pressure Process: AWWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
- C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.4 WALL SHEATHING

- A. Glass-Mat Gypsum Sheathing: ASTM C1177/C1177M.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Georgia-Pacific Gypsum LLC; Dens-Glass Gold or comparable product by one of the following:
 - a. CertainTeed Corporation.
 - b. CertainTeed Gypsum.
 - c. Continental Building Products, LLC.
 - d. National Gypsum Company.
 - e. USG Corporation.
 - 2. Type and Thickness: Type X, 5/8 inch thick.
 - 3. Size: 48 by 96 inches for vertical installation.

2.5 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
- B. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

- C. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.
 - 1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C1002.
 - 2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C954.

2.6 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for Gypsum Sheathing: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated and complying with requirements for elastomeric sealants specified in Section 079200 "Joint Sealants."
- B. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
 - 1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch , of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.
- C. Coordinate all materials with air-barrier system materials and installations. Confirm that all materials are compatible and will not affect any system warranties. Provide alternative sealant materials as required for air-barrier system.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
 - 2. ICC-ES evaluation report for fastener.
- D. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

- E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
 - 1. Wall Sheathing:
 - a. Screw to cold-formed metal framing.
 - b. Space panels 1/8 inch apart at edges and ends.

3.3 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
 - 1. Fasten gypsum sheathing to wood framing with screws.
 - 2. Fasten gypsum sheathing to cold-formed metal framing with screws.
 - 3. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
 - 4. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.
- C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent panels without forcing. Abut ends over centers of studs, and stagger end joints of adjacent panels not less than one stud spacing. Attach at perimeter and within field of panel to each stud.
 - 1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.
- D. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.
 - 1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.
- E. Seal sheathing joints according to sheathing manufacturer's written instructions.
 - 1. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION 061600

SECTION 062023 - INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Interior trim, including non-fire-rated interior door frames.

- B. Related Requirements:

- 1. Section 061053 "Miscellaneous Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.
 - 2. Section 099123 "Interior Painting" for priming and backpriming of interior finish carpentry.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

- 1. Include data for wood-preservative treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained. Include chemical-treatment manufacturer's written instructions for finishing treated material.
 - 2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.

- B. Shop Drawings: Submit shop drawings showing locations of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components. Elevations shall be drawn at a scale of not less than $1/2" = 1'-0"$. Details shall be drawn at a scale of not less than $3" = 1'-0"$.

- 1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - 2. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers and other items installed in architectural woodwork.

- C. Samples for Initial Selection: For each type of product involving selection of colors, profiles, or textures.
- D. Samples for Verification:
 - 1. For each species and cut of lumber and panel products with nonfactory-applied finish, with half of exposed surface finished; 50 sq. in. for lumber and 8 by 10 inches for panels.
 - 2. For each finish system and color of lumber and panel products with factory-applied finish, 50 sq. in. for lumber and 12 inches square for panels.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer. Submit AWI Quality Certification Program certificates for Installer.
- B. Qualification Data: For Fabricator. Submit AWI Quality Certification Program certificates for Fabricator.
- C. Product Certificates: For each type of product, signed by product manufacturer.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Maintenance Data: Include recommended cleaning materials and procedures and list of materials detrimental to each type of material.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program, holding current license(s) in the types of woodwork fabrications required for this Project.
- B. Installer Qualifications: Certified participant in AWI's Quality Certification Program, holding current license(s) in the types of woodwork installations required for this Project.
- C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution. Build mockups in accordance with Division 01 Section "Quality Requirements."
- D. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with sequence-matched wood veneers.
- E. Quality Standard: Fabricate and install all interior architectural woodwork in accordance with the applicable requirements of AWI's "Architectural Woodwork Standards (Edition 2)" for grades of interior architectural woodwork, construction, finishes and other requirements, unless more stringent requirements are specified or shown.
 - 1. Provide AWI Quality Certification Program Labels and Certificates indicating that the woodwork, including installation, complies with requirements of grades specified. The

Contractor, upon award of work, shall register the work under this section with the AWI Quality Certification Program (855-345-0991).

- F. Fire performance and smoke development classification: Materials shall be classified in accordance with one the following, unless specified otherwise in this Section:
 - 1. ASTM E 84 or UL 723, Class B minimum: Flame spread index 26-75; smoke-developed index 0-450
 - 2. NFPA 286.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.
- B. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation.
 - 1. Protect materials from weather by covering with waterproof sheeting, securely anchored.
 - 2. Provide for air circulation around stacks and under coverings.
- C. Deliver interior finish carpentry materials only when environmental conditions comply with requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions comply with requirements specified for installation areas.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet-work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.
- C. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.

2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.9 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Provide AWI Quality Certification Program Labels and Certificates indicating that the woodwork, including installation, complies with requirements of grades specified. The contractor, upon award of work, shall register the work under this section with the AWI Quality Certification Program (855-345-0991).
- B. Fire Performance and Smoke development classification: Materials shall be classified in accordance with one of the following, unless specified otherwise in this section:
 1. ASTM E 84 or UL 723, Class B minimum: Flame spread index 26-75; smoke developed index 0-450.
 2. NFPA 286.
- C. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's (ALSC) Board of Review. Grade lumber by an agency certified by the ALSC's Board of Review to inspect and grade lumber under the rules indicated.
 1. Factory mark each piece of lumber with grade stamp of grading agency.
 2. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by grading agency.
- D. MDF: ANSI A208.2, Grade 130.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2.
 1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 18 percent, respectively.
 2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 3. Do not use material that is warped or does not comply with requirements for untreated material.

4. Mark lumber with treatment-quality mark of an inspection agency approved by the ALSC's Board of Review.
5. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
6. Application: Where indicated on Drawings.

2.3 INTERIOR TRIM

A. Lumber Trim for Opaque Finish (Painted Finish):

1. Species and Grade:
 - a. Eastern white pine; NeLMA or NLGA D Select.
2. Maximum Moisture Content for Softwoods: 15 percent.
3. Finger Jointing: Allowed.
4. Face Surface: Surfaced (smooth).
5. Optional Material: Primed MDF of same actual dimensions as lumber indicated may be used in lieu of lumber.

2.4 MISCELLANEOUS MATERIALS

- ### A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

2.5 FABRICATION

- ### A. Back out or kerf backs of the following members, except those with ends exposed in finished work:
1. Interior standing and running trim, except shoe and crown molds.
- ### B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

3.3 INSTALLATION, GENERAL

- A. Do not use materials that are unsound; warped; improperly treated or finished; inadequately seasoned; too small to fabricate with proper jointing arrangements; or with defective surfaces, sizes, or patterns.
- B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials.
 - 1. Use concealed shims where necessary for alignment.
 - 2. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
 - 3. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
 - 4. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
 - 5. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

3.4 INSTALLATION OF STANDING AND RUNNING TRIM

- A. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available.
 - 1. Do not use pieces less than 24 inches long, except where necessary.
 - 2. Stagger joints in adjacent and related standing and running trim.
 - 3. Miter at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint.
 - 4. Use scarf joints for end-to-end joints.
 - 5. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
 - 6. Install trim after gypsum-board joint finishing operations are completed.
 - 7. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting.
 - 8. Fasten to prevent movement or warping.
 - 9. Countersink fastener heads on exposed carpentry work and fill holes.

3.5 ADJUSTING

- A. Replace interior finish carpentry that is damaged or does not comply with requirements.
 - 1. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.
- B. Adjust joinery for uniform appearance.

3.6 CLEANING

- A. Clean interior finish carpentry on exposed and semiexposed surfaces.
- B. Restore damaged or soiled areas and touch up factory-applied finishes if any.

3.7 PROTECTION

- A. Protect installed products from damage from weather and other causes during construction.
- B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 062023

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SECTION 071113 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Cold-applied, cut-back-asphalt dampproofing at slab-on-grade concrete foundations.
- B. Related Requirements:
 - 1. Section 071326 "Self-Adhering Sheet Waterproofing" for waterproofing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, include recommendations for method of application, primer number of coats, coverage or thickness, and protection course.
- B. Material Certificates: For each product, signed by manufacturers.

1.4 FIELD CONDITIONS

- A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.
- B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain primary dampproofing materials and primers from single source from single manufacturer. Provide protection course, drainage panels, and auxiliary materials recommended in writing by manufacturer of primary materials.

2.2 PERFORMANCE REQUIREMENTS

- A. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction unless otherwise indicated.

2.3 COLD-APPLIED, CUT-BACK-ASPHALT DAMPPROOFING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. APOC, Inc; a division of Gardner Industries.
 - 2. Brewer Company (The).
 - 3. Polyguard Products, Inc.
 - 4. Henry Company.
 - 5. Karnak Corporation.
 - 6. W.R. Meadows, Inc.
- B. Trowel Coats: ASTM D4586/D4586M, Type I, Class 1, fibered.
- C. Brush and Spray Coats: ASTM D4479/D4479M, Type I, fibered or nonfibered.

2.4 AUXILIARY MATERIALS

- A. Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.
- B. Cut-Back-Asphalt Primer: ASTM D41/D41M.
- C. Asphalt-Coated Glass Fabric: ASTM D1668/D1668M, Type I.
- D. Patching Compound: Epoxy or latex-modified repair mortar or asbestos-free fibered mastic of type recommended in writing by dampproofing manufacturer.
- E. Protection Course: Smooth-surfaced roll roofing complying with ASTM D6380/D6380M, Class S, Type III.

2.5 MOLDED-SHEET DRAINAGE PANELS

- A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Composite subsurface drainage panel acceptable to dampproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 sieve laminated to one side of the core, with or without a polymeric film bonded to the other side; and with a vertical flow rate through the core of 9 to 21 gpm per ft..
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Hydrotech, Inc.

- b. BASF Corporation.
- c. Carlisle Coatings & Waterproofing Inc.
- d. CETCO, a Minerals Technologies company.
- e. GCP Applied Technologies Inc.
- f. ISI Building Products.
- g. Polyguard Products, Inc.
- h. Urethane Polymers International, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for surface smoothness, maximum surface moisture content, and other conditions affecting performance of the Work.
- B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for dampproofing application.
- B. Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.
- C. Clean substrates of projections and substances detrimental to dampproofing work; fill voids, seal joints, and remove bond breakers if any.
- D. Apply patching compound to patch and fill tie holes, honeycombs, reveals, and other imperfections; cover with asphalt-coated glass fabric.

3.3 APPLICATION, GENERAL

- A. Comply with manufacturer's written instructions for dampproofing application, cure time between coats, and drying time before backfilling unless otherwise indicated.
 - 1. Apply dampproofing to provide continuous plane of protection.
 - 2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.
- B. Where dampproofing footings and foundation walls, apply from finished-grade line to top of footing; extend over top of footing and down a minimum of 6 inches over outside face of footing.

1. Extend dampproofing 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
2. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where indicated as "reinforced," by embedding an 8-inch-wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat for embedding fabric is in addition to other coats required.
3. Lap dampproofing at least $\frac{1}{4}$ inch onto flashing, masonry ties and other items that penetrate inner wythe.

3.4 COLD-APPLIED, CUT-BACK-ASPHALT DAMPPROOFING

- A. Concrete Foundations and Parged Masonry Foundation Walls: Apply two brush or spray coats at not less than 1.25 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft. for second coat or one trowel coat at not less than 4 gal./100 sq. ft..
- B. Unparged Masonry Foundation Walls: Apply primer and two brush or spray coats at not less than 1.25 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft. for second coat or primer and one trowel coat at not less than 4 gal./100 sq. ft..

3.5 PROTECTION COURSE INSTALLATION

- A. Install protection course over completed-and-cured dampproofing. Comply with dampproofing-material and protection-course manufacturers' written instructions for attaching protection course.
 1. Support protection course over cured coating with spot application of adhesive type recommended in writing by protection-board manufacturer.
 2. Install protection course on same day or within 24 hours of dampproofing installation (while coating is tacky) to ensure adhesion.

3.6 DRAINAGE PANEL INSTALLATION

- A. Molded- Sheet Drainage Panels: Install panels, with geotextile facing away from wall substrate, according to manufacturer's written instructions. Use adhesive or another method that does not penetrate dampproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.
 1. Install protection course before installing drainage panels.

3.7 PROTECTION

- A. Correct dampproofing that does not comply with requirements; repair substrates, and reapply dampproofing.

3.8 CLEANING

- A. Remove dampproofing materials from surfaces not intended to receive dampproofing.

END OF SECTION 071113

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SECTION 071326 - SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Rubberized-asphalt sheet waterproofing system including:
 - a. Primer.
 - b. Transition strip.
 - c. Waterproofing membrane.
 - d. Termination bar.
 - e. Combination subsurface sheet drainage and protection panel.
- B. Related Sections include the following:
 - 1. Division 07 Section "Bituminous Dampproofing".
 - 2. Division 07 Section "Thermal Insulation" for thermal insulation.
 - 3. Division 07 Section "Fluid-Applied Membrane Air Barriers" for transitions.
 - 4. Division 07 Section "Joint Sealants" for joint-sealant materials and installation.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide waterproofing that prevents the passage of water.

1.4 SUBMITTALS

- A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.
- B. Product Test Reports: From a qualified independent testing agency indicating and interpreting test results of waterproofing for compliance with requirements, based on comprehensive testing of current waterproofing formulations.
- C. Sample Warranty: Copy of special waterproofing manufacturer's and Installer's warranty stating obligations, remedies, limitations, and exclusions before starting waterproofing.
- D. Installer Certificate: Current, written certification from manufacturer for installer for specified system.
- E. Material Certificate Letter: Signed by manufacturers.
 - 1. Statement of Compatibility: Provide letter confirming compatibility between self-adhering sheet waterproofing system and air barrier system, for transitions where systems intersect.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who is authorized, approved, or licensed by waterproofing manufacturer to install manufacturer's products.

- B. Source Limitations: Obtain waterproofing system materials through one source from a single manufacturer.
- C. Preinstallation Conference: Conduct conference at Project site to include Architect and Installer. Review requirements for waterproofing, including surface preparation specified under other Sections, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.
- C. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- D. Store rolls according to manufacturer's written instructions.
- E. Protect stored materials from direct sunlight.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
 - 1. Do not apply waterproofing in snow, rain, fog, or mist.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.8 WARRANTY

- A. Special Manufacturer's Warranty: Written warranty, signed by waterproofing manufacturer agreeing to replace waterproofing material that does not comply with requirements or that does not remain watertight during specified warranty period.
 - 1. Warranty does not include failure of waterproofing due to failure of substrate prepared and treated according to requirements or formation of new joints and cracks in substrate exceeding 1/16 inch in width.
 - 2. Warranty Period: Ten years after date of Final Acceptance.
- B. Special Installer's Warranty: Written waterproofing Installer's warranty, signed by Installer, covering Work of this Section, for warranty period of ten years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Carlisle Coatings & Waterproofing
 - 2. GCP Applied Technologies Inc.
 - 3. W. R. Meadows, Inc.

4. Polyguard Products, Inc.

2.2 RUBBERIZED-ASPHALT SHEET WATERPROOFING

- A. Rubberized-Asphalt Sheet: Self-adhering sheet of rubberized asphalt laminated to polyethylene film with release liner on adhesive side and formulated for application with primer or surface conditioner to form a watertight impervious water barrier.
 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carlisle Coatings & Waterproofing, MiraDRI 861.
 - b. GCP Applied Technologies Inc., Bituthene 3000.
 - c. W. R. Meadows, Inc., Mel-Rol.
 - d. Polyguard Products, Inc., 650.
 2. Physical Properties: As follows, measured per standard test methods referenced:
 - a. Thickness: 60-mil minimum (56 mil rubberized asphalt laminated to 4-mil-thick polyethylene film)
 - b. Tensile Strength: 250 psi minimum; ASTM D 412, Die C, modified.
 - c. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
 - d. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970.
 - e. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836.
 - f. Puncture Resistance: 40 lbf minimum; ASTM E 154.
 - g. Hydrostatic-Head Resistance: 150 feet minimum; ASTM D 5385.
 - h. Water Absorption: 0.15 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
 - i. Vapor Permeance: 0.05 perms; ASTM E 96, Water Method.

2.3 COMBINATION SUBSURFACE SHEET DRAINAGE AND PROTECTION PANEL

- A. Drainage Composite Panel: Manufactured, high-compressive-strength, non-biodegradable panel designed to conduct water to foundation drainage system under maximum soil pressure and protect waterproofing membrane. Panel is composed of non-woven polypropylene filter fabric bonded to molded polystyrene core. Panel allows passage of water through fabric, prevents fine soils from entering drainage channel and protects waterproofing membrane.
 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carlisle Coatings & Waterproofing, Inc., MiraDrain 6000XL or 6200XL.
 - b. W. R. Grace & Co., Hydroduct 220.
 - c. W. R. Meadows, Inc., Mel-Drain 5035.
 - d. Polyguard Products, Inc., PolyFlow.
 2. Physical Properties: As follows, measured per standard test methods referenced:
 - a. Flow rate of not less than 14.5 gpm (1.0 gradient) per foot of width at vertical wall pressure of 3600 psf; ASTM 4716.
 - b. Thickness: 0.40 inch minimum; ASTM D 1777 or ASTM C366 method B.
 - c. Tensile Strength: 100 lbs minimum; ASTM D4632.
 - d. Compressive Strength: 15,000 lbs/sq.ft.; ASTM D 1621 modified.
 - e. Fabric CBR Puncture Strength: 275 lbs; ASTM D 6241.

2.4 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
- B. Primer: Liquid primer recommended for substrate by manufacturer of sheet waterproofing material.
- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by manufacturer of sheet waterproofing material.
- D. Transition Strips: Self-adhering, rubberized-asphalt composite sheet strips of same material and thickness as sheet waterproofing.
- E. Liquid Membrane Mastic: Elastomeric, two-component liquid, cold fluid applied, trowel grade, 100% solids, with an elongation of 500% minimum.
- F. Substrate Patching Membrane: Low-viscosity, two-component, asphalt-modified coating.
- G. Adhesives and Tape: Adhesives and adhesive tape recommended by waterproofing manufacturer.
- H. Metal Termination Bars: Stainless steel bars, Type 304, approximately 1 inch wide by 1/8 inch (25 by 3 mm) thick, with predrilled holes for fasteners at no more than 9 inches on center, and with one or two bends to receive sealant.
- I. Mortar Cement for Parging Masonry: ASTM C 1329 factory-prepared masonry mortar cement, Type S.
- J. Filter Fabric: Comply with Division 33 "Subdrainage".

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
 - 1. Verify type and condition of substrate for installation of waterproofing materials. Installer to verify that waterproofing system components are compatible with substrates.
 - 2. Verify that concrete or mortar has cured and aged for minimum time period recommended by waterproofing manufacturer.
 - 3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 QUALITY ASSURANCE

- A. The manufacturer's technical representative shall review the substrate and provide written acceptance of the substrate prior to waterproofing application. The technical representative shall be present during the first hour of waterproofing application. The technical representative shall review the completed self-adhered waterproofing system prior to installation of protection board and provide written acceptance to the General Contractor and the Architect within 24 hours of review.

3.3 SURFACE PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- E. Grind irregular or uneven surfaces to provide a surface that is acceptable to waterproofing manufacturer.
- F. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
 - 1. Install sheet strips and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch.
- G. Bridge and cover isolation joints expansion joints and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips.
 - 1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.
- H. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
 - 1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:
 - a. At footing-to-wall intersections, extend liquid membrane each direction from corner or install membrane strip centered over corner.
- I. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135, and termination bar with liquid membrane lap seal.

3.4 RUBBERIZED-ASPHALT SHEET APPLICATION

- A. Install self-adhering sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.
- B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure watertight installation.
 - 1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, rubberized-asphalt sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.
- D. Apply continuous sheets over sheet strips bridging substrate cracks, construction, and contraction joints.
- E. Seal exposed edges of sheets at terminations not concealed by metal counterflashings or ending in reglets with mastic or sealant.
- F. Install sheet waterproofing and auxiliary materials to tie into adjacent waterproofing.

- G. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheets extending 6 inches beyond repaired areas in all directions.
- H. Correct deficiencies in or remove sheet waterproofing that does not comply with requirements, repair substrates, reapply waterproofing, and repair sheet flashings.
- I. Do not backfill or otherwise cover or conceal waterproofing membrane until review and acceptance by the manufacturer's technical representative and the architect.

3.5 INSTALLATION OF COMBINATION DRAINAGE AND PROTECTION PANEL

- A. Install combination drainage and protection panel over completed waterproofing membrane and according to manufacturer's written instructions. Use adhesives that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity.
- B. Do not backfill or otherwise cover or conceal drainage / protection panel until review and acceptance by the manufacturer's technical representative and the architect.
- C. Install foundation drainage pipe, filter fabric, and fill materials in accordance with Division 33 "Subdrainage" and Drawings.

3.6 PROTECTION AND CLEANING

- A. Cover and secure top edges of drainage panels exposed to view until backfilling and final enclosure is complete. Keep drainage panels secured in place and fastened to substrate to prevent shifting or loosening.
- B. Do not permit foreign objects from entering cavity between drainage panel and waterproofing membrane. Remove drainage panels and clean all cavities where foreign substances have entered cavity. Inspect membrane for damage and repair as required before re-installing drainage panels.
- C. Do not permit foot or vehicular traffic on unprotected membrane. Protect waterproofing from damage and wear during remainder of construction period.
- D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.
- E. Conduct backfilling operations in a manner that does not damage or compromise waterproofing system.

END OF SECTION 071326

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Extruded polystyrene foam-plastic board insulation.
2. Glass-fiber blanket insulation.
3. Mineral-wool blanket insulation.
4. Loose-fill insulation.

- B. Related Requirements:

1. Section 092900 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:

1. Extruded polystyrene foam-plastic board insulation.
2. Glass-fiber blanket insulation.
3. Mineral-wool blanket insulation.
4. Loose-fill insulation.

1.4 INFORMATIONAL SUBMITTALS

- A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.

1. For blown-in or sprayed fiberglass and cellulosic-fiber loose-fill insulation, indicate initial installed thickness, settled thickness, settled R-value, installed density, coverage area, and number of bags installed.
2. Sign, date, and post the certification in a conspicuous location on Project site.

- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

- C. Research Reports: For foam-plastic insulation, from ICC-ES.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
 - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

- A. Extruded Polystyrene Board Insulation, Type IV : ASTM C578, Type IV, 25-psi minimum compressive strength; unfaced.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. DiversiFoam Products.
 - b. Dow Chemical Company (The).
 - c. Kingspan Insulation Limited.
 - d. Owens Corning.
 - 2. Provide insulation with minimum aged R value of 5/ inch thickness at 75 degrees Fahrenheit.
 - 3. Adhesive: Type recommended by insulation board manufacturer for application indicated with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates. Adhesive to be applied with notched trowel over entire wall surface.
- B. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
- C. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
- D. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.2 GLASS-FIBER BLANKET INSULATION

- A. Glass-Fiber Blanket Insulation, Unfaced: ASTM C665, Type I; passing ASTM E136 for combustion characteristics.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corporation.
 - b. Johns Manville; a Berkshire Hathaway company.

- c. Knauf Insulation.
 - 2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 - 3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
 - 4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.
- B. Glass-Fiber Blanket Insulation, Reinforced-Foil Faced: ASTM C665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.
- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corporation.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Knauf Insulation.
 - d. Owens Corning

2.3 MINERAL-WOOL BLANKET INSULATION

- A. Mineral-Wool Blanket Insulation, Unfaced: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; passing ASTM E136 for combustion characteristics.
- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. Owens Corning.
 - c. ROCKWOOL.
 - 2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 - 3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
 - 4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.4 LOOSE-FILL INSULATION

- A. Cellulosic-Fiber Loose-Fill Insulation: ASTM C739, chemically treated for flame-resistance, processing, and handling characteristics.
- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Greenfiber, LLC.
 - b. Hamilton Manufacturing, Inc. (HMI).
 - c. Nu-Wool Co., Inc.
- B. Glass-Fiber Loose-Fill Insulation: ASTM C764, Type I for pneumatic application or Type II for poured application.
- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. [CertainTeed; SAINT-GOBAIN.](#)
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. [Knauf Insulation.](#)
2. Flame-Spread Index: Not more than 5 when tested in accordance with ASTM E84.
 3. Smoke-Developed Index: Not more than 5 when tested in accordance with ASTM E84.

2.5 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
 1. [Manufacturers](#): Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. AGM Industries, Inc.
 - b. Eckel Industries of Canada.
 - c. Gemco.
 - 2.
 3. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 4. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.
- B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
 1. Angle: Formed from 0.030-inch-thick, perforated, galvanized carbon-steel sheet with each leg 2 inches square.
 2. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.
- C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
 1. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap.
- D. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain air space of 2 inches between face of insulation and substrate to which anchor is attached.
- E. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.

2.6 ACCESSORIES

- A. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
 2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.
 3. Polyurethane Pour-In-Place Insulation: Closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84, specifically formulated for pour-in-place applications.
- B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Install insulation with manufacturer's R-value label exposed after insulation is installed.
- D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
1. Fill above tops of all walls to underside of deck with mineral wool at all walls scheduled to be insulated or adjacent to return air plenums.
- E. Coordinate insulation installation to access areas that are made inaccessible by subsequent construction.
- F. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.
- G. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.
- H. Install insulation in thickness required to coordinate with adjacent construction and to provide the minimum aged R-value as follows, or as indicated in drawings, whichever is greater:
1. Exterior CMU walls, above grade: R-9.5 continuous
 2. Exterior framed walls, above grade: R-13 between framing + R-10 continuous

3. Slab-on-grade, unheated, perimeter: R-15 continuous for 24" or to top of footing.

- I. Install foil-faced batt insulation at all areas where insulation will remain uncovered by other surfaces and exposed to cavities and other interstitial spaces including but not limited to wall areas above acoustical ceilings. This does not apply to acoustical batt insulation.
- J. Seal joints between closed-cell (nonbreathing) insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

3.3 INSTALLATION OF SLAB INSULATION

- A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
 - 1. If not otherwise indicated, extend insulation the minimum distance below exterior grade line as indicated on the Drawings.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
 - 1. If not otherwise indicated, extend insulation the minimum distance in from exterior walls as indicated on the Drawings.

3.4 INSTALLATION OF FOUNDATION WALL INSULATION

- A. Butt panels together for tight fit.
- B. Anchor Installation: Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
 - 1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions.
 - 2. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application.
 - 3. Apply insulation standoffs to each spindle to create cavity width indicated on Drawings between concrete substrate and insulation.
 - 4. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation.
 - 5. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.
- C. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

3.5 INSTALLATION OF CAVITY-WALL INSULATION

- A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face and as recommended by manufacturer.
 - 1. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions, and with faces flush.
 - 2. Press units firmly against inside substrates.
 - 3. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 042000 "Unit Masonry."

3.6 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
 - 5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 - 1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.
 - 2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.
- C. Loose-Fill Insulation: Apply according to ASTM C1015 and manufacturer's written instructions.
 - 1. Level horizontal applications to uniform thickness as indicated, lightly settle to uniform density, but do not compact excessively.
 - 2. For cellulosic-fiber loose-fill insulation, comply with CIMA's Bulletin #2, "Standard Practice for Installing Cellulose Insulation."

3.7 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

- B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- C. Provide adequate protection of board insulation as recommended by manufacturer, including but not limited to, compatible waterproof tape at exposed foam surfaces, including corners, window and door openings, if insulation is left exposed longer than the amount of exposure time that is approved by the manufacturer.
- D. Remove and replace insulation that becomes wet.

END OF SECTION 072100

SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Vapor-permeable, fluid-applied air barriers.

1.3 DEFINITIONS

- A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.
- B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.
- C. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Between the trades involved in the whole building's air barrier system, Owner, and Owner Inspection Agency to review trade responsibility and sequence of installation of all the air-tight joints, junctures, and transitions between materials, products and assemblies of products specified in the different sections, to be installed by the different trades.
 - 2. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.

B. Shop Drawings: For air-barrier assemblies.

1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
3. Include details of interfaces with other materials that form part of air barrier.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.

C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

D. Field quality-control reports.

E. Compatibility: Contractor shall submit letter from manufacturer stating that materials proposed for use are permanently chemically compatible and adhesively compatible with adjacent materials propose for use. Submit letter from manufacturer stating that cleaning materials used during installation are chemical compatible with each of the adjacent materials proposed for use.

1.7 QUALITY ASSURANCE

A. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.

1. Contractor shall submit evidence of current accreditation and certification under the Air Barrier Association of America's (ABAA) Quality Assurance Program. Submit accreditation number of manufacturer and certification number of installers.

B. Mockups: Build mockups to set quality standards for materials and execution.

1. Build integrated mockups of exterior wall assembly, 150 sq. ft., incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
 - a. Include junction with roofing membrane, building corner condition, and foundation wall intersection.
 - b. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- B. Protect stored materials from direct sunlight.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.
 1. Protect substrates from environmental conditions that affect air-barrier performance.
 2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.
- B. VOC Content: 100 g/L or less.
- C. Low-Emitting Materials: Verify products comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 PERFORMANCE REQUIREMENTS

- A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

- B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E2357.

2.3 HIGH-BUILD AIR BARRIERS, VAPOR PERMEABLE

- A. High-Build, Vapor-Permeable Air Barrier: Modified bituminous or synthetic polymer membrane with an installed dry film thickness, according to manufacturer's written instructions, of 35 mils or thicker over smooth, void-free substrates.

1. Synthetic Polymer Type:

- a. Products: Subject to compliance with requirements, provide one of the following:

- 1) DuPont de Nemours, Inc.; DuPont™ Sealant for Tyvek® Fluid Applied System or DuPont™ Tyvek® Fluid Applied Flashing and Joint Compound+.
- 2) GCP Applied Technologies Inc.; Perm-A-Barrier VP, Perm-A-Barrier VP 20 LT, or Perm-A-Barrier VPL.
- 3) Henry Company; Air-Bloc 17MR, Air-Bloc 31MR, or Air-Bloc 33MR.
- 4) Tremco Incorporated; ExoAir 230.

2. Physical and Performance Properties:

- a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E2178.
- b. Vapor Permeance: Minimum 10 perms; ASTM E96/E96M, Desiccant Method, Procedure A.
- c. Ultimate Elongation: Minimum 200 percent; ASTM D412, Die C.
- d. Adhesion to Substrate: Minimum 16 lbf/sq. in. when tested according to ASTM D4541.
- e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
- f. UV Resistance: Can be exposed to sunlight for 30 days according to manufacturer's written instructions.

2.4 ACCESSORY MATERIALS

- A. Requirement: Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.
- B. Primer: Liquid waterborne or solvent-borne primer recommended for substrate by air-barrier material manufacturer.

- C. Transition Membrane at metal flashings: Modified bituminous, 40 mils thick, self-adhering sheet consisting of 36 mils of rubberized asphalt laminated to a 4 mils thick, cross-laminated polyethylene film with release liner backing.
- D. Transition Membrane at compatible roof membranes: Vapor-retarding, 40 mils thick, smooth surfaced, selfadhering;consisting of 36 mils of rubberized asphalt laminated to a 4 mils thick polyethylene film with release liner backing.
- E. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Section 079200 "Joint Sealants."
- F. Termination Mastic: Air-barrier manufacturer's sealant or liquid membrane for sealing penetrations and top edge terminations of transition membrane and counter flashing strip.
- G. Joint Reinforcing Strip for use on gypsum sheathing: Air-barrier manufacturer's glass-fiber-mesh tape or plastic sheathing tape acceptable to air barrier manufacturer.
- H. Substrate-Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
- I. Adhesive and Tape: Air-barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.
- J. Sprayed Polyurethane Foam Sealant: One- or two-component, foamed-in-place, polyurethane foam sealant, 1.5- to 2.0-lb/cu. ft (24- to 32-kg/cu. m) density; flame-spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.
- K. Elastomeric Flashing Sheet: ASTM D 2000, 2BC415 to 3BC620, minimum 50- to 65 mils thick, cured sheet neoprene with manufacturer's recommended contact adhesives and lap sealant with stainless-steel termination bars and fasteners or aluminum termination bars and stainless-steel fasteners.
- L. Expansion joint membrane: Roof expansion joint, dual-seal, double-flanged, weldable, extruded thermoplastic rubber system for sealing expansion joints in roof made of NPVC. Provide with pre-formed corners and transitions where required.
 - 1. Provide EMSEAL Roofing, RJ-0200-NP or approved equal

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 - 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.

2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
 3. Verify that substrates are visibly dry and free of moisture. Test concrete substrates for capillary moisture by plastic sheet method according to ASTM D4263.
 4. Verify that masonry joints are flush and completely filled with mortar.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.
- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.
- H. Bridge isolation joints, expansion joints, and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.
- I. Patch all holes and voids and smooth out any surface misalignments.
- J. Patch all cracks, protrusions, small voids, offsets, details, irregularities and small deformities with cementitious patching mortar at least two hours before application.

3.3 ACCESSORIES INSTALLATION

- A. Install accessory materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.
 1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
 2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.

3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
 4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
- B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
 - C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
 - D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
 - E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip or preformed silicone extrusion so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.
 1. Transition Strip: Roll firmly to enhance adhesion.
 - F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
 - G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
 - H. Seal top of through-wall flashings to air barrier with an additional 6-inch-wide, transition strip.
 - I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
 - J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.
- ### 3.4 PRIMARY AIR-BARRIER MATERIAL INSTALLATION
- A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.
 1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
 2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.

3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.
- B. High-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply air-barrier material in full contact around protrusions such as masonry ties.
 1. Vapor-Permeable, High-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, but not less than 35 mils, applied in one or more equal coats.
- C. Do not cover air barrier until it has been tested and inspected by testing agency.
- D. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.5 FIELD QUALITY CONTROL

- A. ABAA Quality Assurance Program: Perform examinations, preparation, installation, testing, and inspections under ABAA's Quality Assurance Program.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
 1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
 2. Air-barrier dry film thickness.
 3. Continuous structural support of air-barrier system has been provided.
 4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
 5. Site conditions for application temperature and dryness of substrates have been maintained.
 6. Maximum exposure time of materials to UV deterioration has not been exceeded.
 7. Surfaces have been primed, if applicable.
 8. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
 9. Termination mastic has been applied on cut edges.
 10. Strips and transition strips have been firmly adhered to substrate.
 11. Compatible materials have been used.
 12. Transitions at changes in direction and structural support at gaps have been provided.
 13. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
 14. All penetrations have been sealed.
- D. Tests: As determined by testing agency from among the following tests:

1. Air-Leakage-Location Testing: Air-barrier assemblies will be tested for evidence of air leakage according to ASTM E1186, chamber pressurization or depressurization with smoke tracers or ASTM E1186, chamber depressurization using detection liquids Insert requirement.
 2. Air-Leakage-Volume Testing: Air-barrier assemblies will be tested for air-leakage rate according to ASTM E783 or ASTM E2357.
 3. Adhesion Testing: Air-barrier assemblies will be tested for required adhesion to substrate according to ASTM D4541 for each 600 sq. ft. of installed air barrier or part thereof.
- E. Air barriers will be considered defective if they do not pass tests and inspections.
1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
 2. Remove and replace deficient air-barrier components for retesting as specified above.
- F. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.
- G. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

- A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer's written instructions.
 2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.
- C. Remove masking materials after installation.

END OF SECTION 072726

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SECTION 073113 - ASPHALT SHINGLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Glass-fiber-reinforced asphalt shingles.
 - 2. Underlayment materials.

1.3 DEFINITIONS

- A. Roofing Terminology: See ASTM D1079 for definitions of terms related to roofing Work in this Section.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Asphalt shingles.
 - 2. Underlayment materials.
 - 3. Asphalt roofing cement.
 - 4. Elastomeric flashing sealant.
- B. Shop Drawings: For metal flashing and trim.
- C. Samples: For each exposed product and for each color and blend specified, in sizes indicated.
 - 1. Asphalt Shingles: Full size.
 - 2. Ridge and Hip Cap Shingles: Full size.
- D. Samples for Initial Selection:
 - 1. For each type of asphalt shingle indicated.
 - 2. For each type of accessory involving color selection.

- E. Samples for Verification: For the following products, in sizes indicated:
 - 1. Asphalt Shingles: Full size.
 - 2. Ridge and Hip Cap Shingles: Full size.
 - 3. Exposed Valley Lining: 12 inches (305 mm) square.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each type of asphalt shingle and underlayment product indicated, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.
- C. Research Reports: For synthetic underlayment, from an agency acceptable to authorities having jurisdiction or ICC-ES, indicating that product is suitable for intended use under applicable building codes.
- D. Sample Warranty: For manufacturer's materials warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For asphalt shingles to include in maintenance manuals.
- B. Materials warranties.
- C. Roofing Installer's warranty.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Asphalt Shingles: 100 sq. ft. of each type and in each color and blend, in unbroken bundles.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized installer who is trained and approved by manufacturer.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Store roofing materials in a dry, well-ventilated location protected from weather, sunlight, and moisture in accordance with manufacturer's written instructions.
- B. Store underlayment rolls on end, on pallets or other raised surfaces. Do not double-stack rolls.

- C. Protect unused roofing materials from weather, sunlight, and moisture when left overnight or when roofing Work is not in progress.
- D. Handle, store, and place roofing materials in a manner to prevent damage to roof deck or structural supporting members.

1.11 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with installation only when existing and forecasted weather conditions permit product installation and related Work to be performed in accordance with manufacturer's written instructions and warranty requirements.
 - 1. Install self-adhering, polymer-modified bitumen sheet underlayment within the range of ambient and substrate temperatures recommended in writing by manufacturer.

1.12 WARRANTY

- A. Materials Warranty: Manufacturer agrees to repair or replace asphalt shingles that fail within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Manufacturing defects.
 - 2. Materials Warranty Period: NDL Warranty of **25** years from date of Substantial Completion, prorated, with first **five** years nonprorated.
 - 3. Wind-Speed Warranty Period: Asphalt shingles will resist blow-off or damage caused by wind speeds of up to 130 mph for **15** years from date of Substantial Completion.
 - 4. Algae-Resistance Warranty Period: Asphalt shingles will not discolor for **10** years from date of Substantial Completion.
 - 5. Workmanship Warranty Period: **20** years from date of Substantial Completion.
- B. Roofing Installer's Warranty: On warranty form at end of this Section, signed by Installer, in which Installer agrees to repair or replace components of asphalt shingle roofing that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: **Five** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of product from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Exterior Fire-Test Exposure: Provide asphalt shingles and related roofing materials identical to those of assemblies tested for Class A fire resistance in accordance with ASTM E108 or UL 790 by Underwriters Laboratories or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
- B. Wind Resistance: Provide asphalt shingles that comply with requirements of ASTM D3161/D3161M, Class F, and with ASTM D7158/D7158M, Class H.

2.3 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

- A. Laminated-Strip Architectural Asphalt Shingles: ASTM D3462/D3462M, laminated, multi-ply overlay construction; glass-fiber reinforced, mineral-granule surfaced, and self-sealing.
 - 1. Basis of Design: Timberline HDZ High Definition Lifetime Shingles, by GAF
 - 2. Wood shake appearance with 5 5/8" exposure.
 - 3. Strip Size: Manufacturer's standard self sealing starter strip.
 - 4. Algae Resistance: Granules resist algae discoloration.
 - 5. Color and Blends: As selected by Architect from manufacturer's full range
- B. Hip and Ridge Shingles: Distinctive self-sealing hip and ridge cap shingle complementing the color of the selected roof shingle.
 - 1. Manufacturer's standard units to match asphalt shingles

2.4 LEAK BARRIER

- A. Self-adhering, self-sealing, bituminous leak barrier surfaced with synthetic patterned surface. Approved by UL, Dade County, ICC, State of Florida and Texas Department of Insurance. Each Roll contains approx. 200 sq ft. (18.6 sq m), 36 inches x 66.7 feet (0.9 m x 20.3 m) and 60 mils thick.

2.5 UNDERLAYMENT MATERIALS

- A. Organic Felt: Asphalt-saturated organic felts, nonperforated and complying with the following:
 - 1. ASTM D226/D226M or ASTM D4869/D4869M: Type II.
 - 2. Weight: 30 lb. minimum.
- B. Self-Adhering, Polymer-Modified Bitumen Sheet: ASTM D1970/D1970M, minimum 40-mil-thick sheet; glass-fiber-mat-reinforced, polymer-modified asphalt; with slip-resistant top surface and release backing; cold applied.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Grace Ice & Water Shield by GCP Applied Technologies Inc., or a comparable product as approved by the Architect.

2.6 ACCESSORIES

- A. Asphalt Roofing Cement: ASTM D4586/D4586M Type II, asbestos free.
- B. Elastomeric Flashing Sealant: ASTM C920, Type S, Grade NS, one-part, non-sag, elastomeric polymer sealant; of class and use classifications required to seal joints and remain watertight; recommended in writing by manufacturer for installation of flashing systems.
- C. Roofing Nails: ASTM F1667, aluminum, stainless steel, copper, or hot-dip galvanized-steel wire shingle nails, minimum 0.120-inch-diameter, sharp-pointed, with a 3/8- to 7/16-inch-diameter flat head and of sufficient length to penetrate not less than 1" long and at least 1/4 inch through sheathing less than 3/4 inch thick.
 - 1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.
- D. Underlayment Nails: Aluminum, stainless steel, or hot-dip galvanized-steel wire nails with low-profile metal or plastic caps, 1-inch-minimum diameter.
 - 1. Provide with minimum 0.0134-inch-thick metal cap, 0.010-inch-thick power-driven metal cap, or 0.035-inch-thick plastic cap; and with minimum 0.083-inch-thick ring shank or 0.091-inch-thick smooth shank of length to penetrate at least 3/4 inch into roof sheathing or to penetrate through roof sheathing less than 3/4 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored and that provisions have been made for flashings and penetrations through asphalt shingles.
 - 3. Verify that vent stacks and other penetrations through roofing are installed and securely fastened.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT MATERIALS

- A. Comply with asphalt shingle and underlayment manufacturers' written installation instructions and with recommendations in NRCA's "The NRCA Roofing Manual: Steep-Slope Roof

Systems" applicable to products and applications indicated unless more stringent requirements are specified in this Section or indicated on Drawings.

1. Install on roof deck parallel with and starting at the eaves.

- B. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free, on roof sheathing under asphalt shingles. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply over entire roof, in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.

1. Apply slip sheet over underlayment before installing asphalt shingles.

3.3 INSTALLATION OF METAL FLASHING AND TRIM

- A. Install metal flashings and trim to comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."

1. Install metal flashings in accordance with recommendations in ARMA's "Asphalt Roofing Residential Manual - Design and Application Methods" and NRCA's "NRCA Guidelines for Asphalt Shingle Roof Systems."

2. Bed flanges of metal flashings using asphalt roofing cement or elastomeric flashing sealant.

- B. Apron Flashings: Extend lower flange over and beyond each side of downslope asphalt shingles and up the vertical surface.

- C. Step Flashings: Install with a headlap of 2 inches and extend over underlying shingle and up the vertical face.

1. Install with lower edge of flashing just upslope of, and concealed by, butt of overlying shingle.

2. Fasten to roof deck only.

- D. Cricket and Backer Flashings: Install against roof-penetrating elements extending concealed flange beneath upslope asphalt shingles and beyond each side.

- E. Counterflashings: Coordinate with installation of base flashing and fit tightly to base flashing. Lap joints a minimum of 4 inches secured in a waterproof manner.

1. Install in reglets or receivers.

- F. Rake Drip Edges: Install over underlayment materials and fasten to roof deck.

- G. Eave Drip Edges: Install below underlayment materials and fasten to roof deck.

- H. Pipe Flashings: Form flashing around pipe penetrations and asphalt shingles. Fasten and seal to asphalt shingles as recommended by manufacturer.

3.4 INSTALLATION OF ASPHALT SHINGLES

- A. Install asphalt shingles in accordance with manufacturer's written instructions and recommendations in ARMA's "Asphalt Roofing Residential Manual - Design and Application Methods" and NRCA's "NRCA Guidelines for Asphalt Shingle Roof Systems."
- B. Install starter strip along lowest roof edge, consisting of an asphalt shingle strip at least 7 inches wide with self-sealing strip face up at roof edge.
 - 1. Extend asphalt shingles 1/2 inch over fasciae at eaves and rakes.
 - 2. Install starter strip along rake edge.
- C. Install first and remaining courses of laminated asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.
- D. Fasten asphalt shingle strips with a minimum of six roofing nails, but not less than the number indicated in manufacturer's written instructions for roof slope and design wind speed indicated on Drawings and for warranty requirements specified in this Section.
 - 1. Locate fasteners in accordance with manufacturer's written instructions.
 - 2. Where roof slope is less than 4:12, hand seal self-sealing asphalt shingles to improve the shingles' positive bond by applying asphalt roofing cement spots between course overlaps after nailing the upper course.
 - 3. When ambient temperature during installation is below 50 deg F, hand seal self-sealing asphalt shingles by applying asphalt roofing cement spots between course overlaps after nailing the upper course.
- E. Closed-Cut Valleys: Extend asphalt shingle strips from one side of valley 12 inches beyond center of valley.
 - 1. Use one-piece shingle strips without joints in valley.
 - 2. Fasten with extra nail in upper end of shingle. Install asphalt shingle courses from other side of valley and cut back to a straight line 2 inches short of valley centerline.
 - 3. Trim upper concealed corners of cut-back shingle strips.
 - 4. Do not nail asphalt shingles within 6 inches of valley center.
 - 5. Set trimmed, concealed-corner asphalt shingles in a 3-inch-wide bed of asphalt roofing cement.
- F. Ridge Vents: Install continuous ridge vents over asphalt shingles in accordance with manufacturer's written instructions. Fasten with roofing nails of sufficient length to penetrate sheathing.
- G. Hip and Ridge Shingles: Maintain same exposure of cap shingles as roofing-shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds.
 - 1. Fasten with roofing nails of sufficient length to penetrate sheathing.
 - 2. Fasten ridge cap asphalt shingles to cover ridge vent without obstructing airflow.

END OF SECTION 073113

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SECTION 074113.16 - STANDING-SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Standing-seam metal roof panels. (Alternate)

- B. Related Sections:

- 1. Section 012300 "Alternates" for standing-seam metal roof panel alternate.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

- 1. Meet with Owner, Architect, General Contractor, roofing installer, roofing installer foreman, roofing installer crew, metal roof system manufacturer's technical representative, structural deck installer, sheet metal flashing installer, sheet metal flashing installer, snow guard installer, fall protection anchorage system installer, and installers whose work interfaces with or affects metal panels, including installers of roof accessories and roof-mounted equipment.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 - 5. Review structural loading limitations of deck and structure during and after roofing.
 - 6. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal panels.

7. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
8. Review temporary protection requirements for metal panel systems during and after installation.
9. Review procedures for repair of metal roof panels damaged after installation.
10. Review installation of snow guard system and fall protection anchorage system.
11. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings:
 1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
 2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.
 3. Certification for Insulation, in accordance with North Carolina State Building Code, Energy Conservation Code:
 - a. Certification listing insulation type, manufacturer and R-value. Installer shall sign, date and post the certification in a conspicuous location on the jobsite.
- C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.
 1. Include similar samples of trim and accessories involving color selection.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
 1. Metal Panels: 8 inches long by actual panel width. Include clips, fasteners, closures, and other metal panel accessories.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Evaluation Reports: From ICC-ES or other testing and inspecting agency acceptable to authorities having jurisdiction, indicating that product is suitable for intended use under applicable building codes for the following:
 - 1. Metal roofing, fasteners, and attachment systems.
 - 2. High-temperature self-adhering underlayment.
- D. Field quality-control reports.
- E. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
 - 1. A firm with not less than 10 years of successful experience in installation of metal roof panel systems similar to those required for this project. As a minimum, the roofing foreman shall be certified and trained by metal roof panel system manufacturer and shall be experienced in the application of the specified system. The roofing foreman shall be on site at all times during the work. Written certification must be provided.
- B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.
- C. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 1. Surface-Burning Characteristics: ASTM E 84.
 - 2. Fire-Resistance Ratings: ASTM E 119.
 - 3. Combustion Characteristics: ASTM E 136.
- D. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockups for typical roof area only, including accessories.
 - a. Size: 12 feet long by 6 feet.
 - b. Each type of exposed seam and seam termination.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.
- E. Handle, store, and place roofing materials in a manner to prevent damage to roof deck or structural supporting members.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.10 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.
- B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 WARRANTY

- A. All warranties shall be coordinated and provided in accordance with Section 017410 "Roof Warranties".

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
 - 1. Wind Loads: As indicated on Structural Drawings.
 - 2. Other Design Loads: As indicated on Structural Drawings.
 - 3. Deflection Limits: For wind loads, no greater than 1/180 of the span.
- B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E1680 or ASTM E283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E1646 or ASTM E331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- D. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E2140.
- E. Exterior Fire-Test Exposure for Roof Assembly: Provide metal roof panels and related roofing materials identical to those of assemblies tested for Class A fire resistance according to ASTM E 108 or UL 790 by Underwriters Laboratories, Inc. or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
- F. Interior Flame Spread and Fuel Contribution for Roof Assembly: Meets performance requirements of UL 1256.
- G. Thermal Movements:
 - 1. Completed metal roofing and flashing system shall be capable of withstanding expansion and contraction of components caused by changes in temperature without buckling, or reducing performance ability.
 - 2. The design temperature differential shall be not less than 220 degrees Fahrenheit.
 - 3. Interface between panel and clip shall provide for unlimited thermal movement in each direction along the longitudinal direction.

2.2 STANDING-SEAM METAL ROOF PANELS

- A. Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
 - 1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E1514.

- B. Vertical-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and mechanically seaming panels together.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or comparable products as approved by the Architect:
 - a. ATAS International, Inc.
 - b. Berridge Manufacturing Company.
 - c. CENTRIA.
 - d. Fabral.
 - e. PAC-CLAD; Petersen Aluminum Corporation; a Carlisle company.
 2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
 - a. Nominal Thickness: 20 gauge.
 - b. Exterior Finish: Three-coat metallic fluropolymer.
 - c. Color: As selected by Architect from manufacturer's full range of standard and premium colors.
 - d. Panel coverage: 16 inches
 - e. Standing-Seams Height: 2 inches
 3. Clips: Two-piece floating to accommodate thermal movement.
 - a. Material: 0.0250-inch- thick, stainless steel sheet.
 - b. Material for Floating Base: 0.050-inch stainless steel sheet.
 4. Joint Type: As standard with manufacturer.
 5. Panel Coverage: As selected by the Architect from the manufacturer's full range.
 6. Panel Height: Manufacturer's standard.

2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 40 mils thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.
1. Thermal Stability: Stable after testing at 240 deg F; ASTM D1970.
 2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D1970.
 3. Basis-of-Design Product: Subject to compliance with requirements, provide Grace Ice and Water Shield HT by GCP Applied Technologies, or a comparable product as approved by the Architect.

2.4 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C645; cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 coating designation or ASTM A792/A792M, Class AZ50 coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, fascia, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
 - 1. Closures: Provide closures at eaves, valleys, and ridges, fabricated of same metal as metal panels.
 - 2. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
 - 3. Ridges, Valleys, Flashing and Trim: See Section 76200 "Sheet Metal Flashing and Trim" for additional requirements.
 - a. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - b. Nominal Thickness: 0.040 inch minimum.
 - c. Exterior Finish: Three-coat metallic fluoropolymer, to match roof panels.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads.
- E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
 - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
 - 2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
 - 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.5 FABRICATION

- A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 - 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

2.6 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
 - 1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
 - 2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Prevent materials from entering and clogging roof gutters and downspouts and from spilling or migrating onto surfaces of other construction.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

3.3 INSTALLATION OF UNDERLAYMENT

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Extend underlayment into gutter trough. Roll laps with roller. Cover underlayment within 14 days.
 - 1. Apply over the entire roof surface.
- B. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 076200 "Sheet Metal Flashing and Trim."

3.4 INSTALLATION OF STANDING SEAM METAL ROOF PANELS

- A. Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 1. Shim or otherwise plumb substrates receiving metal panels.
 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
 3. Install screw fasteners in predrilled holes.
 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 5. Install flashing and trim as metal panel work proceeds.
 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
 1. Steel Panels: Use stainless steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
- C. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.
- D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.
 1. Install clips to supports with self-tapping fasteners.
 2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 3. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.
 4. Watertight Installation:
 - a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommend in writing by manufacturer as needed to make panels watertight.
 - b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
 - c. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

- F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete metal panel system including trim, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.
- G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 - 1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.
 - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- H. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.5 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect metal roof panel installation, including accessories. Report results in writing.
- B. Remove and replace applications of metal roof panels where tests and inspections indicate that they do not comply with specified requirements.
- C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- D. Prepare test and inspection reports.

3.7 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.
- C. Do not use graphite pencil to mark metal surfaces.

END OF SECTION 074113.16

SECTION 074213.13 – FORMED METAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Exposed-fastener, lap-seam metal wall panels.

- B. Related Sections:

- 1. Division 01 Section “Quality Requirements” for Integrated Exterior Mockups.
 - 2. Division 01 Section “Roof Warranties” for Sheet Metal flashing & trim
 - 3. Division 05 Section "Cold-Formed Metal Framing" for support framing, including girts, studs, and bracing.
 - 4. Division 07 Section “Joint Sealants: for field-applied sealants not otherwise specified in this Section.
 - 5. Division 13 Section “Metal Building Systems” for installing metal wall panels with the metal buildings.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

- 1. Meet with Owner, Architect, metal panel Installer, metal panel manufacturer's representative, and structural-support Installer.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
 - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 - 5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
 - 6. Review temporary protection requirements for metal panel assembly during and after installation.
 - 7. Review of procedures for repair of metal panels damaged after installation.
 - 8. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

- 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of wall panel and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, fastener locations, and accessories; and special details. Distinguish between factory-, shop- and field-assembled work.
2. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches (1:10):
 - a. Flashing and trim, including trim at penetrations.
 - b. Anchorage systems.

C. Samples for Initial Selection: For each type of exposed metal wall panel indicated with factory-applied color finishes, provide manufacturer printed color charts.

D. Samples for Verification: For each type of exposed metal wall panel indicated with factory-applied color finishes, match Architects sample (Basis of Design: MBCI – Natural Patina).

1. Include samples of trim and accessories involving color selection.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal wall panels to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Fabricator Qualifications: Certified by metal-faced composite wall panel manufacturer to fabricate and install manufacturer wall panel system.

C. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.

D. Source Limitations: Obtain each type of metal wall panel through one source from a single manufacturer.

E. Product Options: Drawings indicate size, profiles, and dimensional requirements of metal wall panels are based on the specific system indicated. Refer to Division 1 Section “Product Requirements”.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect’s approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

- F. Fire Resistance Ratings: Where indicated, provide metal wall panels identical to those of assemblies tested for fire resistance per ASTM E 119 by testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Combustion Characteristics: ASTM E 136
 - 2. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
 - 3. Metal wall panels shall be identified with appropriate markings from an applicable testing and inspecting agency.
- G. Surface Burning Characteristics: Provide insulated wall panels having insulation core materials with the following surface burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Flame Spread Index: 25 or less, unless otherwise specified
 - 2. Smoke Developed Index, 450 or less, unless otherwise specified
- H. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockup of typical metal panel assembly as shown on Drawings, including corner, supports, attachments, and accessories. See Division 01 Section "Quality Requirements" for Integrated Exterior Mockups.
 - 2. Water-Spray Test: Conduct water-spray test of metal panel assembly mockup, testing for water penetration according to AAMA 501.2
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.
- B. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal wall panel for period of metal wall panel installation.

1.9 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed according to manufacturers' written instructions and warranty requirements.

1.10 COORDINATION

- A. Coordinate metal wall panel installation with rain drainage work, flashing, trim, and construction of girts, studs, soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: 5 years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Source Limitations: The same metal wall panel products shall be installed on the PEMB buildings and the office building.

2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.
 - 3. Deflection Limits: For wind loads, no greater than 1/240 of the span.
- B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa).
- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of

connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- E. Seismic Performance: Provide metal wall panel assemblies capable of withstanding the effects of earthquake motions determined to ASCE 7, "Minimum Design Loads for Buildings and other Structures": Section 9, "Earthquake Loads".

2.3 CONCEALED-FASTNER LAP-SEAM METAL WALL PANELS

- A. Provide factory-formed metal panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation
- B. Creased-Rib-Profile, Concealed-Fastener Metal Wall Panels: Formed with raised, center-creased, trapezoidal major ribs; with reveal joint between panels.
1. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 coating designation; structural quality. Pre-painted by the coil-coating process to comply with ASTM A755/A755M.
 - a. a. Nominal Thickness: 18 gauge.
 - b. b. Exterior Finish: As selected by the Architect from the manufacturer's full range.
 - c. c. Color: As selected by Architect from manufacturer's full range of standard and premium colors.
 2. Panel Coverage: As selected by the Architect from the manufacturer's full range.
 3. Panel Height: Manufacturer's standard.
 4. Attached on Z-furring channels as indicated on the Drawings.

2.4 METAL SOFFIT PANELS

- A. Provide metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to support using concealed fasteners in side laps. Include accessories required for weathertight installation.
- B. Metal Soffit Panels:
1. Finish: Finish and material to match metal siding
 2. Sealant: Factory applied within interlocking joint.
- C. Flush-Profile Metal Soffit Panels: Perforated panels formed with vertical panel edges and a flat pan between panel edges; with flush joint between panel.
1. Material: Finish and material to match metal siding
 2. Panel Coverage: As selected by the architect from the manufacturer's full range.
 3. Panel Height: 5/8" inch
 4. Provide J-Trim as indicated on the Drawings.

2.5 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A792/A792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
 - 1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
 - 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 - 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
 - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
 - 2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
 - 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.6 FABRICATION

- A. Fabricate and finish metal wall panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. Fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.

4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.7 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Steel Panels and Accessories:
 1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of Work.
 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

3.3 INSTALLATION

- A. General: Install metal wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal

wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Commence metal wall panel installation and install minimum of 300 sq. ft. (27.8 sq. m.) in presence of factory-authorized representative.
2. Shim or otherwise plumb substrates receiving metal wall panels.
3. Flash and seal metal wall panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal wall panels are installed.
4. Install screw fasteners in predrilled holes.
5. Locate and space fastenings in uniform vertical and horizontal alignment.
6. Install flashing and trim as metal wall panel work proceeds.
7. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
8. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
9. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
10. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
11. Any penetrations through air-barrier assembly shall be fully sealed prior to installation of panels. Air-barrier will be inspected after subgirt and framing installation and prior to installation of panels.

B. Fasteners:

1. Steel Wall Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal wall panel manufacturer.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.

1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

E. Lap-Seam Metal Wall Panels: Fasten metal wall panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal wall panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
5. Flash and seal panels with weather closures at perimeter of all openings.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.
- G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Water-Spray Test: After completing the installation of 75-foot- (23-m-) by-2-story minimum area of metal wall panel assembly, test assembly for water penetration according to AAMA 501.2 in a 2-bay area directed by Architect.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect and test completed metal wall panel installation, including accessories.
- D. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.
- E. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- F. Prepare test and inspection reports.

3.5 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.
- B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Formed wall sheet metal fabrications.
- B. Related Requirements:
 - 1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Section 077100 "Roof Specialties" for roof-edge drainage systems, and counterflashings.

1.3 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site .
 - 1. Review modification procedures for existing wall panels and panel flashing.
 - 2. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
 - 4. Review requirements for insurance and certificates if applicable.
 - 5. Review sheet metal flashing observation and repair procedures after flashing installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each of the following
 - 1. Underlayment materials.
 - 2. Elastomeric sealant.

3. Butyl sealant.
4. Epoxy seam sealer.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of roof-penetration flashing.
9. Include details of edge conditions, including flashings and counterflashings.
10. Include details of special conditions.
11. Include details of connections to adjoining work.
12. Detail formed flashing and trim at scale of not less than 3 inches per 12 inches.

C. Samples: For each exposed product and for each color and texture specified, 12 inches long by actual width.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.
- B. Special warranty.

1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mock-up of typical window head and sill through wall flashing and wall flashing at grade, approximately 6 feet long, including supporting seams attachments, underlayment and accessories.
2. Provide additional mock-ups in mock-up wall as required for exterior integrated mockup specified in Division 01 "Quality Requirements".
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.
 1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
 2. Protect stored sheet metal flashing and trim from contact with water.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.10 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

- A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface. Provide one of the following finishes to match adjacent materials as approved by the Architect:
 - 1. As-Milled Finish: Mill.
 - 2. Clear Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
 - 3. Color Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
 - a. Color Range: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
 - 4. Color: As selected by Architect from manufacturer's full range of 64 available colors minimum .
 - a. Architect will select (2) colors to coordinate with adjacent exterior finishes.
 - 5. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.
- C. Stainless Steel Sheet: ASTM A240/A240M, Type 304, dead soft, fully annealed; with smooth, flat surface.
 - 1. Finish: ASTM A480/A480M, No. 2D (dull, cold rolled).
 - a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
 - b. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1) Run grain of directional finishes with long dimension of each piece.

- 2) When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- 3) Thickness: 0.019 inches (26 gauge) minimum.
- 4) Foil-faced, rolled flashing will not be accepted.
- 5) Locations: Use at all through-wall flashing, counterflashing, and where indicated in drawings. See Division 04 "Unit Masonry" for additional requirements.

2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet Underlayment: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer in accordance with underlayment manufacturer's written instructions.
1. Source Limitations: Obtain underlayment from single source from single manufacturer.
 2. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F or lower.

2.4 MISCELLANEOUS MATERIALS

- A. Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 3. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
 4. Fasteners for Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329.
 5. Fasteners for masonry substrates: ¼ inch by length required for 1 inch penetration into masonry, expansion type anchor with stainless steel nail. Rawl Zamac Nailin fastener or equal.
- C. Solder:

1. For Stainless Steel: ASTM B32, Grade Sn60, with acid flux of type recommended by stainless steel sheet manufacturer.
- D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- E. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- H. Bituminous Coating: Cold-applied asphalt emulsion in accordance with ASTM D1187/D1187M.
- I. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.
- J. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cheney Flashing Company.
 - b. Fry Reglet Corporation.
 - c. Hohmann & Barnard, Inc.
 - d. Keystone Flashing Company, Inc.
 - e. National Sheet Metal Systems, Inc.
 2. Source Limitations: Obtain reglets from single source from single manufacturer.
 3. Material: Stainless steel, 0.0188 inch thick .
 4. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
 5. Accessories:
 - a. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.
 6. Finish: 2D Dull, Type 304 .

2.5 FABRICATION, GENERAL

- A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.
 1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:

1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal. Provide cleats with one gauge higher thickness than adjacent flashing thickness.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

G. Seams:

1. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

H. Do not use graphite pencils to mark metal surfaces.

2.6 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

A. Apron, Step, Cricket, and Backer Flashing: Fabricate from one of the following materials:

1. Aluminum: 0.032 inch thick.
2. Stainless Steel: 0.0156 inch thick.

- B. Valley Flashing: Fabricate from the following materials:
 - 1. Stainless Steel: 0.0188 inch thick.
- C. Drip Edges: Fabricate from one of the following materials:
 - 1. Aluminum: 0.032 inch thick.
 - 2. Stainless Steel: 0.0156 inch thick.
- D. Eave, Rake, Ridge, and Hip Flashing: Fabricate from one of the following materials:
 - 1. Aluminum: 0.032 inch thick.
 - 2. Stainless Steel: 0.0156 inch thick.
- E. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from one of the following materials:
 - 1. Aluminum: 0.032 inch thick.
 - 2. Stainless Steel: 0.0188 inch thick.
- F. Flashing Receivers: Fabricate from one of the following materials:
 - 1. Aluminum: 0.032 inch thick.
 - 2. Stainless Steel: 0.0156 inch thick.
- G. Roof-Penetration Flashing: Fabricate from the following materials:
 - 1. Stainless Steel: 0.0188 inch thick.

2.7 WALL SHEET METAL FABRICATIONS

- A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch-long, but not exceeding 12-foot-long, sections, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings; and form with 2-inch-high, end dams. Fabricate from the following materials:
 - 1. Stainless Steel: 0.0156 inch thick.
- B. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch-high, end dams. Fabricate from one of the following materials:
 - 1. Aluminum: 0.032 inch thick.
 - 2. Stainless Steel: 0.0156 inch thick.
- C. Wall Expansion-Joint Cover: Fabricate from one of the following materials:
 - 1. Aluminum: 0.040 inch thick.
 - 2. Stainless Steel: 0.0188 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
 - 1. Verify compliance with requirements for installation tolerances of substrates.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 - 3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT

- A. Self-Adhering, High-Temperature Sheet Underlayment:
 - 1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
 - 2. Prime substrate if recommended by underlayment manufacturer.
 - 3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
 - 4. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses.
 - 5. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller.
 - 6. Roll laps and edges with roller.
 - 7. Cover underlayment within 14 days.

3.3 INSTALLATION, GENERAL

- A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.
 - 1. Install fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, or sealant.
 - 3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
 - 5. Install continuous cleats with fasteners spaced not more than 12 inches o.c.
 - 6. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.

7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
 8. Do not field cut sheet metal flashing and trim by torch.
 9. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Coat concealed side of uncoated-aluminum and stainless steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
1. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
 2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
 3. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
1. Use sealant-filled joints unless otherwise indicated.
 - a. Embed hooked flanges of joint members not less than 1 inch into sealant.
 - b. Form joints to completely conceal sealant.
 - c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.
 - d. Adjust setting proportionately for installation at higher ambient temperatures.
 - 1) Do not install sealant-type joints at temperatures below 40 deg F.
 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter.
1. Pretin edges of sheets with solder to width of 1-1/2 inches; however, reduce pretinning where pretinned surface would show in completed Work.
 2. Do not solder aluminum sheet.

3. Do not use torches for soldering.
 4. Heat surfaces to receive solder, and flow solder into joint.
 - a. Fill joint completely.
 - b. Completely remove flux and spatter from exposed surfaces.
 5. Stainless Steel Soldering:
 - a. Tin edges of uncoated sheets, using solder for stainless steel and acid flux.
 - b. Promptly remove acid-flux residue from metal after tinning and soldering.
 - c. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
- H. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.4 INSTALLATION OF ROOF FLASHINGS

- A. Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard.
1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
 2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Roof Edge Flashing:
1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
 2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
- C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless steel draw band and tighten.
- D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.
1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
 2. Extend counterflashing 4 inches over base flashing.
 3. Lap counterflashing joints minimum of 4 inches.
 4. Secure in waterproof manner by means of snap-in installation and sealant or lead wedges and sealant or interlocking folded seam or blind rivets and sealant unless otherwise indicated.
- E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.5 INSTALLATION OF WALL FLASHINGS

- A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.
- C. Refer to SMACNA Architectural Sheet Metal Manual Figures 4-3A, 4-3B, 4-3E and specification details.
- D. At through-wall flashing and monitors, insert upper edge in metal receiver. Bend receiver neatly and snugly to face of counterflashing.
- E. Notch and lap joints and inside corners. Notch and solder outside corners. Do not rivet or otherwise secure joints and corners.
- F. Lap ends 4 inches. Crimp hem of overlapping section around hem of underlapping section.

3.6 INSTALLATION OF MISCELLANEOUS FLASHING

- A. Equipment Support Flashing:
 - 1. Coordinate installation of equipment support flashing with installation of roofing and equipment.
 - 2. Weld or seal flashing with elastomeric sealant to equipment support member.
- B. Overhead-Piping Safety Pans:
 - 1. Suspend pans from structure above, independent of other overhead items such as equipment, piping, and conduit, unless otherwise indicated on Drawings.
 - 2. Pipe and install drain line to plumbing waste or drainage system.

3.7 INSTALLATION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.8 CLEANING

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.

3.9 PROTECTION

- A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.
- C. Maintain sheet metal flashing and trim in clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 076200

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SECTION 077100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Roof-edge drainage systems.
 - 2. Counterflashings.
 - 3. Gutters & Downspouts

- B. Related Requirements:

- 1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Section 076200 "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.
 - 3. Section 079200 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.

- C. Preinstallation Conference: Conduct conference at Project site

- 1. Meet with Owner, Architect, roofing-system testing and inspecting agency representative, roofing Installer, roofing-system manufacturer's representative, Installer, structural-support Installer, and installers whose work interfaces with or affects roof specialties, including installers of roofing materials and accessories.
 - 2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
 - 3. Review special roof details, roof drainage, and condition of other construction that will affect roof specialties.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

- B. Shop Drawings: For roof specialties.

- 1. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work.

2. Include details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
 3. Indicate profile and pattern of seams and layout of fasteners, cleats, clips, and other attachments.
 4. Detail termination points and assemblies, including fixed points.
 5. Include details of special conditions.
- C. Samples: For each type of roof specialty and for each color and texture specified.
- D. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.
- E. Samples for Verification:
1. Include Samples of each type of roof specialty to verify finish and color selection, in manufacturer's standard sizes.
 2. Include roof-edge drainage systems, reglets and counterflashings made from 12-inch (300-mm) lengths of full-size components in specified material, and including fasteners, cover joints, accessories, and attachments.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Product Certificates: For each type of roof specialty.
- C. Product Test Reports: For roof-edge flashings, for tests performed by a qualified testing agency.
- D. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are FM Approvals listed for specified class and SPRI ES-1 tested to specified design pressure.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.
- B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.
- B. Coordination: Coordinate roof specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 ROOF-EDGE DRAINAGE SYSTEMS

- A. Gutters: Manufactured in uniform section lengths not exceeding 12 feet, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.
 - 1. Zinc-Coated Steel: Nominal 0.034-inch (0.86-mm) thickness.
 - 2. Gutter Profile: Style A according to SMACNA's "Architectural Sheet Metal Manual."
 - 3. Embossed Surface: Embossed with design as indicated by manufacturer's designations

4. Corners: Factory mitered and welded
 5. Gutter Supports: Gutter brackets with finish matching the gutters.
 6. Gutter Accessories: Continuous screed leaf guard with sheet metal frame.
- B. Downspouts: Plain rectangular or plain round as approved by the Architect, complete with machine-crimped, mitered, or smooth-curve elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
1. Zinc-Coated Steel: Nominal 0.034-inch (0.86-mm) thickness.
- C. Zinc-Coated Steel Finish: Three-coat fluoropolymer
1. Color: as selected by Architect from manufacturer's full range.

2.3 REGLETS AND COUNTERFLASHINGS

- A. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:
1. Zinc-Coated Steel: Nominal 0.028-inch (0.71-mm) thickness.
 2. Corners: Factory mitered and continuously welded
 3. Surface-Mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
 4. Multiuse Type, Embedded: For multiuse embedment in masonry mortar joints.
- B. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches (100 mm) and in lengths not exceeding 12 feet (3.6 m) designed to snap into reglets or through-wall-flashing receiver and compress against base flashings with joints lapped, from the following exposed metal:
1. Zinc-Coated Steel: Nominal 0.028-inch (0.71-mm) thickness.

2.4 MATERIALS

- A. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
- B. Aluminum Extrusions: ASTM B221, alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:
- C. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.
- D. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 (Z275) coating designation.

2.5 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: ASTM D1970/D1970M; stable after testing at 240 deg F.
2. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F.

2.6 MISCELLANEOUS MATERIALS

- A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
 1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
 2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
 3. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
 4. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A153/A153M or ASTM F2329.
- B. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.
- C. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- D. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

2.7 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Coil-Coated Aluminum Sheet or Aluminum Extrusion Finishes:
 1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 2. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
 3. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
- C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.
 - 1. Apply continuously under roof-edge specialties and counterflashings.
 - 2. Coordinate application of self-adhering sheet underlayment under roof specialties with requirements for continuity with adjacent air barrier materials.

3.3 INSTALLATION, GENERAL

- A. Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.
 - 1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
 - 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
 - 3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
 - 4. Torch cutting of roof specialties is not permitted.
 - 5. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of uncoated aluminum and stainless steel roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.

2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.
- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise indicated on Drawings.
 2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
- D. Fastener Sizes: Use fasteners of sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.
- F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.4 INSTALLATION OF ROOF-EDGE DRAINAGE-SYSTEM

- A. Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.
- B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 12 inches apart. Attach ends with rivets and seal with sealant or solder to make watertight. Slope to downspouts.
1. Install gutter with expansion joints at locations indicated but not exceeding 50 feet apart. Install expansion-joint caps.
- C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c.
1. Connect downspouts to underground drainage system indicated.
 2. Anchor scupper closure trim flange to exterior wall and seal or solder to scupper.
 3. Loosely lock front edge of scupper with conductor head.
 4. Seal or solder exterior wall scupper flanges into back of conductor head.
- D. Splash Pans: Install where downspouts discharge on low-slope roofs. Set in asphalt roofing cement or elastomeric sealant.

- E. Conductor Heads: Anchor securely to wall with elevation of conductor top edge 1 inch below gutter discharge.

3.5 INSTALLATION OF COUNTERFLASHINGS

- A. Coordinate installation of counterflashings with installation of base flashings.
- B. Counterflashings: Insert counterflashings into indicated receivers; ensure that counterflashings overlap 4 inches over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches and bed with butyl sealant. Fit counterflashings tightly to base flashings.

3.6 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.
- D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077100

SECTION 077253 - SNOW GUARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Pad-type, seam-mounted plastic snow guards.

1.3 ACTION SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for snow guards.
- B. Shop Drawings: Include roof plans showing layouts and attachment details of snow guards.
- C. Delegated-Design Submittal: For snow guards, include analysis reports signed and sealed by the qualified professional engineer, licensed in the State of North Carolina, responsible for their preparation.
 - 1. Include calculation of number and location of snow guards based on snow load, roof slope, roof type, components, spacings, and finish.
- D. Samples: Full-size unit with installation hardware.
 - 1. For units with factory-applied finishes, submit manufacturer's standard color selections.
- E. Test Reports: Results of product tensile load testing by an independent testing laboratory showing ultimate load-to-failure value of attachment.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of snow guard, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit adhesive-mounted snow guards to be installed, and adhesive cured, according to adhesive manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Division 01 Section "Quality Requirements," to design snow guards, including attachment to roofing material and roof deck, as applicable for attachment method, based on the following:
1. Roof snow load.
 2. Snow drifting
 3. Roof slope.
 4. Roof type.
 5. Roof dimensions.
 6. Roofing substrate type and thickness.
 7. Snow guard type.
 8. Snow guard fastening method and strength.
 9. Snow guard spacing.
 10. Coefficient of Friction Between Snow and Roof Surface: 0.
 11. Factor of Safety: 2.
- B. Performance Requirements: Provide snow guards that withstand exposure to weather and resist thermally induced movement without failure, rattling, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- C. Structural Performance: Snow guards shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
1. Snow Loads: As indicated on Drawings.
 2. Design snow guard system to resist minimum in-service vector load of at least 300 pounds per linear foot of eave, or greater if required by NC Building Code.
 3. Confirm with metal roof panel manufacturer that the metal roof panel attachment is sufficient to withstand loads applied by snow guard system.
- D. Design Requirements: Roof plan shows general location of snow guards. Snow guard manufacturer to calculate quantity and location of snow guard rails and components based on NC Building Code requirements, loads indicated in structural drawings, geographical location of Project, building characteristics and roof slope. Snow guard manufacturer to design clamp attachment to Project's standing seam metal roof.

2.2 Pad-Type Snow Guards

- A. Seam-Mounted Plastic Snow Guard Pads:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Alpine SnowGuards, a Division of Vermont Slate and Copper Services, Inc.
 - b. IceBlox, Inc. d.b.a. Snoblox-Snojax.
 - c. Zaleski Snow Guards for Roofs, Inc.
 2. Material: Clear UV-stabilized polycarbonate.

3. Attachment: Manufacturer's tested system, capable of resisting design loads.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, snow guard attachment, and other conditions affecting performance of the Work.
 1. Verify compatibility with and suitability of substrates including compatibility with existing finishes or primers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean and prepare substrates for bonding snow guards.
- B. Prime substrates according to snow guard manufacturer's written instructions.

3.3 INSTALLATION

- A. Install snow guards according to manufacturer's written instructions. Space rows as designed by manufacturer and per reviewed shop drawings.
- B. Attachment for Standing-Seam Metal Roofing:
 1. Do not use fasteners that will penetrate metal roofing, or fastening methods that void metal roofing finish warranty.
 2. Seam-Mounted, Pad-Type Snow Guards:
 - a. Install snow guards in straight rows.
 - b. Secure in place using stainless steel set screws, incorporating round non penetrating point.
 - c. Torque set screw according to manufacturer's instructions.

END OF SECTION 077253

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SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Penetration firestopping systems for the following applications:

- a. Penetrations in fire-resistance-rated walls.
 - b. Penetrations in horizontal assemblies.
 - c. Penetrations in smoke barriers.

- B. Related Requirements:

- 1. Section 078443 "Joint Firestopping" for joints in or between fire-resistance-rated construction and in smoke barriers.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

- 1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

- B. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements".
- B. Installer Qualifications: A firm experienced in installing fire-resistive joint systems similar in material, design, and extent to that indicated for this project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install the manufacturer's products per specified requirements. Manufacturer's willingness to sell their fire-resistive joint system products to contractor or to installer engaged by Contractor does not in itself confer qualification on buyer.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
 - 1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
 - a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.

- 1) UL in its "Fire Resistance Directory."

2.2 PENETRATION FIRESTOPPING SYSTEMS

- A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. 3M Fire Protection Products.
 - b. A/D Fire Protection Systems Inc.
 - c. Everkem Diversified Products, Inc.
 - d. Grabber Construction Products.
 - e. Hilti, Inc.
 - f. HoldRite; Reliance Worldwide Company.
 - g. International Fireproof Technology Inc.
 - h. NUCO Inc.
 - i. Passive Fire Protection Partners.
 - j. RectorSeal Firestop; a CSW Industrials Company.
 - k. Roxtec.
 - l. Specified Technologies, Inc.
 - m. STC Sound Control.
 - n. Tremco, Inc.
- B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
 1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
 1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
 2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
 3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.
- D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg.
 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at and no more than 50-cfm cumulative total for any 100 sq. ft. at both ambient and elevated temperatures.

- E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E84.
- F. Manufactured Piping Penetration Firestopping System: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
 - 1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
 - 2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
 - 3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.
 - 4. Sleeve: Molded-PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
 - 5. Stack Fitting: ASTM A48/A48M, gray-iron, hubless-pattern wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
 - 6. Special Coating: Corrosion resistant on interior of fittings.
- G. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.
 - 1. Permanent forming/damming/backing materials.
 - 2. Substrate primers.
 - 3. Collars.
 - 4. Steel sleeves.

2.3 FILL MATERIALS

- A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.
- E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

- G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
- I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

2.4 MIXING

- A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

- A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.
- C. Install fill materials by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.
 - 1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.
- B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Designation of applicable testing and inspecting agency.
 - 4. Date of installation.
 - 5. Manufacturer's name.
 - 6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E2174.
- B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.
- C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

3.7 PENETRATION FIRESTOPPING SYSTEM SCHEDULE

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.
- B. Where Intertek Group-listed systems are indicated, they refer to design numbers in Intertek Group's "Directory of Listed Building Products" under "Firestop Systems."
- C. Where FM Approval-approved systems are indicated, they refer to design numbers listed in FM Approval's "Approval Guide" under "Wall and Floor Penetration Fire Stops."
- A. Penetration Firestopping with No Penetrating Items:
 - 1. UL-Classified Systems: C-AJ-0001-0999 and W-L-0001-0999.
 - 2. Type of Fill Materials: As required to achieve rating.
- B. Penetration Firestopping for Metallic Pipes, Conduit, or Tubing:
 - 1. UL-Classified Systems: C-AJ-1001-1999 and W-L-1001-1999.
 - 2. Type of Fill Materials: As required to achieve rating.
- C. Penetration Firestopping for Nonmetallic Pipe, Conduit, or Tubing:
 - 1. UL-Classified Systems: C-AJ-2001-2999 and W-L-2001-2999.
 - 2. Type of Fill Materials: As required to achieve rating.

D. Penetration Firestopping for Electrical Cables:

1. UL-Classified Systems: C-AJ-3001-3999 and W-L-3001-3999.

E. Penetration Firestopping for Cable Trays with Electric Cables:

1. UL-Classified Systems: C-AJ-4001-4999 and W-L-4001-4999.
2. Type of Fill Materials: As required to achieve rating.

F. Penetration Firestopping for Insulated Pipes:

1. UL-Classified Systems: C-AJ-5001-5999 and W-L-5001-5999.
2. Type of Fill Materials: As required to achieve rating.

G. Penetration Firestopping for Miscellaneous Electrical Penetrants:

1. UL-Classified Systems: C-AJ-6001-6999 and W-L-6001-6999.
2. Type of Fill Materials: As required to achieve rating.

H. Penetration Firestopping for Miscellaneous Mechanical Penetrants:

1. UL-Classified Systems: C-AJ-7001-7999 and W-L-7001-7999.
2. Type of Fill Materials: As required to achieve rating.

I. Penetration Firestopping for Groupings of Penetrants:

1. UL-Classified Systems: C-AJ-8001-8999 and W-L-8001-8999.
2. Type of Fill Materials: As required to achieve rating.

END OF SECTION 078413

SECTION 078443 - JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Joints in or between fire-resistance-rated constructions.
 - 2. Joints in smoke barriers.

- B. Related Requirements:

- 1. Section 078413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers and for wall identification.
 - 2. Section 092216 "Non-Structural Metal Framing" for firestop tracks for metal-framed partition heads.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.

- 1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

- B. Product Test Reports: For each joint firestopping system, for tests performed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."
- B. Installer Qualifications: A firm experienced in installing fire-resistive joint systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its fire-resistive joint system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.9 COORDINATION

- A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of joints to accommodate joint firestopping systems.
- C. Notify Owner's testing agency at least seven days in advance of joint firestopping system installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:

1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
 - a. Joint firestopping systems shall bear classification marking of a qualified testing agency.
 - 1) UL in its "Fire Resistance Directory."

2.2 MANUFACTURERS

- A. [Manufacturers](#): See UL Details in Drawings for available manufacturers.
1. Fire Protection materials denoted in the fire protection details provided in the Contract Documents shall not be construed as proprietary. Equivalent fire protection systems may be utilized if submitted by the Contractor following requirements set forth in Article 8 of the General Conditions of the Contract and Division 01 Section "Product Requirements."

2.3 JOINT FIRESTOPPING SYSTEMS

- A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
- B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E 1966 or UL 2079:
1. Joints include those installed in or between fire-resistance-rated walls and floor or floor/ceiling assemblies.
 2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.
- C. Joints at Exterior Curtain-Wall/Floor Intersections: Provide joint firestopping systems with rating determined per ASTM E 2307.
1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.
- D. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- E. VOC Content: Fire-resistive joint system sealants shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1. Architectural Sealants: 250 g/L.
 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 3. Sealant Primers for Porous Substrates: 775 g/L.
- F. Accessories: Provide components of joint firestopping systems, including primers and forming materials, that are needed to install fill materials and to maintain ratings required. Use only

components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Before installing joint firestopping systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
 - 1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
 - 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Prime substrates where recommended in writing by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent fill materials of joint firestopping system from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing joint firestopping system's seal with substrates.

3.3 INSTALLATION

- A. General: Install joint firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

- C. Install elastomeric fill materials for joint firestopping systems by proven techniques to produce the following results:
 - 1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
 - 2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
 - 3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Designation of applicable testing agency.
 - 4. Date of installation.
 - 5. Manufacturer's name.
 - 6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E2393.
- B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.
- C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

- A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.
- B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated joint firestopping systems immediately and install new materials to produce joint firestopping systems complying with specified requirements.

3.7 JOINT FIRESTOPPING SYSTEM SCHEDULE

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHBN.
- A. Floor-to-Floor, Joint Firestopping Systems:
 - 1. UL-Classified Systems: FF-S (D as required)-0000-0999.
- B. Wall-to-Wall, Joint Firestopping Systems:
 - 1. UL-Classified Systems: WW-S (D as required)-0000-0999.
- C. Floor-to-Wall, Joint Firestopping Systems:
 - 1. UL-Classified Systems: FW-S (D as required)-0000-0999.
- D. Head-of-Wall, Joint Firestopping Systems:
 - 1. UL-Classified Systems: HW-S (D as required)-0000-0999.
- E. Bottom-of-Wall, Joint Firestopping Systems:
 - 1. UL-Classified Systems: BW-S (D as required)-0000-0999.
- F. Wall-to-Wall, Joint Firestopping Systems Intended for Use as Corner Guards:
 - 1. UL-Classified Systems: CG-S (D as required)-0000-0999.
- G. Perimeter Joint Firestopping Systems:
 - 1. UL-Classified Perimeter Fire-Containment Systems: CW-S (D as required)-0000-0999.

END OF SECTION 078443

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Silicone joint sealants.
2. Nonstaining silicone joint sealants.
3. Urethane joint sealants.
4. Immersible joint sealants.
5. Silyl-terminated polyether joint sealants.
6. Mildew-resistant joint sealants.
7. Butyl joint sealants.
8. Latex joint sealants.

- B. Related Requirements:

1. Section 079219 "Acoustical Joint Sealants" for sealing joints in sound-rated construction.

1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Joint-Sealant Schedule: Include the following information:
 1. Joint-sealant application, joint location, and designation.
 2. Joint-sealant manufacturer and product name.
 3. Joint-sealant formulation.
 4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.

- C. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
- D. Field-Adhesion-Test Reports: For each sealant application tested.
- E. Sample Warranties: For special warranties.
- F. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- G. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.
- H. Material Certificate Letters: Signed by product manufacturers.
 - 1. Statement of Compatibility: Provide letter confirming compatibility between joint sealant and air barrier system.
 - 2. Statement of Compatibility: Provide letter confirming compatibility between joint sealant and dampproofing material.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Testing Agency Qualifications: Qualified according to ASTM C1021 to conduct the testing indicated.
- C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
 - 1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
 - 2. Conduct field tests for each kind of sealant and joint substrate.
 - 3. Notify Architect seven days in advance of dates and times when test joints will be erected.
 - 4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.

- a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
 - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.7 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 2. When joint substrates are wet.
 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: 20 years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 2. Disintegration of joint substrates from causes exceeding design specifications.
 3. Mechanical damage caused by individuals, tools, or other outside agents.

4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following manufacturers:
 1. Pecora Corporation
 2. Sonneborn Building Products
 3. Tremco

2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
- B. Provide sealants and sealant primers for use within the Building Interior that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):
 1. Architectural Sealants: 250 g/L.
 2. Nonmembrane Roof Sealants: 300 g/L.
 3. Single-Ply Roof Membrane Sealants: 450 g/L.
 4. Sealant Primers for Nonporous Substrates: Not more than 250 g/L.
 5. Sealant Primers for Porous Substrates: 775 g/L.
 6. Other Sealant Primers: 750 g/L.
- C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
 1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- D. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- E. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- F. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range of at least 20 color options.

2.3 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- B. Locations: Provide silicone sealant for all food service locations and exterior locations, including but not limited to, exterior expansion and control joints, concrete, precast, masonry, metal wall panels, metal soffits, metal flashing and trim for walls and roofs, roofing penetrations and curbs, storefront and curtainwall perimeter, and canopy locations.
- C. Sustainability Requirement: At interior sealant locations, VOC is limited to 250 g/L maximum.
- D. Single-Component Mildew-Resistant Neutral-Curing Silicone Sealant:
 - 1. Type and Grade: S (single component) and NS (nonsag).
 - 2. Classes: 25.
 - 3. Use Related to Exposure: NT (nontraffic).
 - 4. Uses Related to Joint Substrates: G, A and O, as applicable to joint substrates indicated, O as recommended by sealant manufacturer.
- E. Single-Component Mildew-Resistant Neutral-Curing Silicone Sealant:
 - 1. Type and Grade: S (single component) and NS (nonsag).
 - 2. Classes: 50.
 - 3. Use Related to Exposure: NT (nontraffic).
 - 4. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O as recommended by sealant manufacturer.
- F. Single-Component Mildew-Resistant Traffic Silicone Sealant: Use at all paved areas.
 - 1. Type and Grade: S (single component) and NS (nonsag).
 - 2. Use Related to Exposure: T (traffic).
 - 3. Self leveling.
 - 4. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O as recommended by sealant manufacturer.
- G. Multiple-Component Mildew-Resistant Neutral-Curing Silicone Sealant:
 - 1. Type and Grade: M (multiple component) and NS (nonsag).
 - 2. Class: 50.
 - 3. Use Related to Exposure: NT (nontraffic).
 - 4. Uses Related to Joint Substrates: M, G, A, and O, as applicable to joint substrates indicated, O as recommended by sealant manufacturer.

2.4 LATEX JOINT SEALANTS – For Interior Use Only

- A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Building Systems; Sonolac.
 - b. Pecora Corporation; AC-20+.
 - c. Tremco Incorporated; Tremflex 834.

- B. Sustainability Requirement: At interior sealant locations, VOC is limited to 250 g/L maximum.

2.5 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

2.6 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after

cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

- a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
3. Remove laitance and form-release agents from concrete.
 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
 - e. Stainless steel

- B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform

beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
4. Provide flush joint configuration where indicated per Figure 5B in ASTM C 1193.
5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 5C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 079200

SECTION 079219 - ACOUSTICAL JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Acoustical joint sealants.
- B. Related Requirements:
 - 1. Section 079200 "Joint Sealants" for elastomeric, latex, and butyl-rubber-based joint sealants for nonacoustical applications.

1.3 ACTION SUBMITTALS

- A. Product Data: For each acoustical joint sealant.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Acoustical-Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each kind of acoustical joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.
- B. Sample Warranties: For special warranties.

1.5 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace acoustical joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish acoustical joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Manufacturer's standard.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Provide acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies according to ASTM E90.
 - 1. Verify sealant has a VOC content of 250 g/L or less.

2.2 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Sealant for Exposed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C834.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Accumetric LLC; BOSS 826 Acoustical Sound Sealant.
 - b. Everkem Diversified Products, Inc.; SoundSeal 90 Draft, Smoke and Acoustical Sound Sealant.
 - c. Franklin International; Titebond GREENchoice Professional Acoustical Smoke & Sound Sealant.
 - d. GE Construction Sealants; Momentive Performance Materials Inc.; RCS20 Acoustical.
 - e. Grabber Construction Products; Acoustical Sealant GSC.
 - f. Hilti, Inc.; CP 506 Smoke and Acoustical Sealant.
 - g. OSI Sealants; Henkel Corporation; OSI Pro-Series SC-175 Acoustical Sound Sealant.
 - h. Pecora Corporation; AC-20 FTR or AIS-919.
 - i. Serious Energy Inc.; Quiet Seal Pro.
 - j. Specified Technologies, Inc.; SpecSeal Smoke 'N' Sound Sealant.
 - k. Tremco Incorporated; Tremco Acoustical Sealant.
 - l. USG Corporation; SHEETROCK Acoustical Sealant.

2. Colors of Exposed Acoustical Joint Sealants: As selected by Architect from manufacturer's full range of colors.
- B. Acoustical Sealant for Concealed Joints: Manufacturer's standard nonsag, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber acoustical sealant.
 1. Products: Subject to compliance with requirements, provide one of the following or one of the products indicated above for exposed joints:
 - a. Pecora Corporation; BA-98.
 - b. Serious Energy Inc.; Quiet Seal 350.

2.3 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by acoustical-joint-sealant manufacturer where required for adhesion of sealant to joint substrates.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive acoustical joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where recommended by acoustical-joint-sealant manufacturer. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or

by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

- A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.
- B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C919, ASTM C1193, and manufacturer's written recommendations for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.
- C. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of acoustical joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect acoustical joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated acoustical joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 079219

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes:
 - 1. Interior standard steel doors and frames.
 - 2. Exterior standard steel doors and frames.
- B. Related Requirements:
 - 1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.4 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.
- C. A shop drawing coordination meeting shall be held before door, door frame, and door hardware shop drawings are submitted. The purpose of this meeting will be to coordinate doors, frames, door hardware, and electrical rough-ins. The Contractor shall notify the owner, designer, and affected subcontractors, and schedule the meeting. The electrical contractor shall prepare conduit and box rough-in drawings for each door/frame requiring electronic systems or other wiring and bring these drawings to the coordination meeting. The affected trades shall coordinate wiring, rough-ins, door opening construction, door frame and door hardware installation prior to the submission of door shop drawings or electrical rough-in.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
 - 7. Details of anchorages, joints, field splices, and connections.
 - 8. Details of accessories.
 - 9. Details of moldings, removable stops, and glazing.
- C. Samples for Initial Selection: For hollow-metal doors and frames with factory-applied color finishes.
- D. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For door inspector.
 - 1. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.
- B. Product Test Reports: For each type of fire-rated hollow-metal door and frame assembly for tests performed by a qualified testing agency indicating compliance with performance requirements.
- C. Field quality control reports.

1.7 CLOSEOUT SUBMITTALS

- A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.8 QUALITY ASSURANCE

- A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies shall meet the qualifications set forth in NFPA 80, section 5.2.3.1 and the following:

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.
- B. Egress Door Inspector Qualifications: Inspector for field quality control inspections of egress door assemblies shall meet the qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:
 1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Baron Metal Industries Inc.; an Assa Abloy Group company.
 2. Ceco Door; ASSA ABLOY.
 3. Curries Company; ASSA ABLOY.
 4. DKS Steel Door & Frame Systems, Inc.
 5. Fleming Door Products Ltd.; Assa Abloy Group Company.
 6. Karpen Steel Custom Doors & Frames.
 7. Mesker Door Inc.
 8. Pioneer Industries.
 9. Republic Doors and Frames.
 10. Steelcraft; an Allegion brand.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
- B. Fire-Rated, Borrowed-Lite Assemblies: Assemblies complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A. At locations indicated in the Door and Frame Schedule
 1. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Uncoated steel sheet, minimum thickness of 0.042 inch.
 - d. Edge Construction: Model 2 , Seamless
 - e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
 - f. Core: Vertical Steel Stiffener
 - g. Fire-Rated Core: Manufacturer's standard laminated mineral board core for fire-rated doors.
 2. Frames:
 - a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
 - b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
 - c. Construction: Full profile welded, unless otherwise indicated.
 3. Exposed Finish: Prime.

2.4 EXTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A.
 1. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches.

- c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
 - d. Edge Construction: Model 2, Seamless
 - e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
 - f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
 - g. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
 - h. Core: Polyisocyanurate
 - i. Fire-Rated Core: Manufacturer's standard vertical steel stiffener with insulation or laminated mineral board core for fire-rated doors.
- 2. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
 - b. Construction: Full profile welded, unless otherwise indicated.
- 3. Exposed Finish: Prime.

2.5 BORROWED LITES

- A. Fabricate of uncoated or metallic-coated steel sheet to match adjacent door and frame, minimum thickness of 0.053 inch.
- B. Construction: Full profile welded, unless otherwise indicated.
- C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.
- D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.6 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
 - 2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
 - 3. Postinstalled Expansion Anchor: Minimum 3/8-inch-diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

4. Jamb anchors for plaster and gypsum wallboard partition openings shall be a minimum of 18-gauge steel.
- B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
- C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of underlayment.
- D. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
 1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized according to ASTM A153/A153M, Class B.

2.7 MATERIALS

- A. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- B. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.
- C. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.
- D. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- E. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.
- F. Glazing: Comply with requirements in Section 088000 "Glazing."

2.8 FABRICATION

- A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding, or by rigid mechanical anchors.
 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
 4. Terminated Stops (Hospital Stops): Terminate stops 6 inches above finish floor with a 45-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.
- C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to ANSI/SDI A250.6, the Door Hardware Schedule, and templates.
1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.
- D. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with mitered hairline joints.
1. Provide stops and moldings flush with face of door, and with beveled stops unless otherwise indicated.
 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
 4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
 5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

2.9 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.10 LOUVERS

- A. Provide louvers for interior doors, where indicated, which comply with SDI 111, with blades or baffles formed of 0.020-inch-thick, cold-rolled steel sheet set into 0.032-inch-thick steel frame.
 - 1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.
- B. Form corners of moldings with hairline joints. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.

2.11 FINISH HARDWARE REINFORCEMENT

- A. Fabricate reinforcement plates from same material as frames to comply with the following minimum sizes:
 - 1. Hinges: 12 gauge, continuous channel for the full height of door.
 - 2. Closers: 12 gauge, continuous channel for the full length of the header.
 - 3. Strikes: 14 gauge, continuous channel for the full height of the door.
 - 4. Hinges on Frames: 7-gauge reinforcements.
 - 5. 7-gauge reinforcements shall be used for hinges on frames. 26-gauge steel plaster guards or mortar boxes welded to the frame shall be provided at hardware cutouts where installed in concrete, masonry or plaster openings.
- B. ACCESSORIES
 - 1. Kerfed Stops: Provide frames with integral kerf at door side of door stop at all locations where door is indicated to be a sound sealed door, smoke-rated door or a fire rated door. Provide manufacturer's standard friction fit neoprene or rubber seal except provide alternate seal where required for door assembly rating.
 - 2. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
 - 3. Supports and Anchors: Fabricated from metallic-coated steel sheet.
 - 4. Removable Mullions: Provide hollow metal steel mullion where indicated. Mullion to be prepared for keyed cylinder lock feature and be fitted with required hardware for permitting removal of mullion from frame with use of a key. Mullion to be constructed similar to frames above.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

- A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.
- B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
 - a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
 - b. Install frames with removable stops located on secure side of opening.
 - 2. Fire-Rated Openings: Install frames according to NFPA 80.
 - 3. Floor Anchors: Secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 - 4. Solidly pack mineral-fiber insulation inside frames.
 - 5. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors.
 - 6. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
 - 1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8, NAAMM-HMMA 841, and NAAMM-HMMA guide specification indicated.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 - 3. Smoke-Control Doors: Install doors according to NFPA 105.
- D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

- A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Inspections:
 - 1. Fire-Rated Door Inspections: Inspect each fire-rated door according to NFPA 80, Section 5.2.
 - 2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements according to NFPA 101, Section 7.2.1.15.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 REPAIR

- A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- C. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.
- D. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

3.5 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

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SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Five-ply flush wood veneer-faced doors for transparent finish.
2. Five-ply flush wood doors for opaque finish.
3. Factory priming and finishing flush wood doors.
4. Factory fitting flush wood doors to frames and factory machining for hardware.

- B. Related Requirements:

1. Section 088000 "Glazing" for glass view panels in flush wood doors.
2. Section 099123 "Interior Painting" for field finishing doors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product, including the following:

1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Door louvers.
5. Door trim for openings.
6. Door frame construction.
7. Factory-machining criteria.
8. Factory-priming and finishing specifications.

- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door schedule indicating door location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Details of frame for each frame type, including dimensions and profile.
4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
5. Dimensions and locations of blocking for hardware attachment.
6. Dimensions and locations of mortises and holes for hardware.

7. Clearances and undercuts.
8. Requirements for veneer matching.
9. Doors to be factory primed and finished and application requirements.
10. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples for Initial Selection: For factory-finished doors.

D. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
2. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.
3. Louver blade and frame sections, 6 inches long, for each material and finish specified.
4. Frames for light openings, 6 inches long, for each material, type, and finish required.
5. Plastic laminate, 6 inches square, for each color, texture and pattern selected.
6. Frames for light openings, 6 inches long, for each material , type and finish required.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For door inspector.

1. Submit copy of DHI's Fire and Egress Door Assembly Inspector (FDAI) certificate.

B. Field quality-control reports.

C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Special warranties.

B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

C. Quality Standard Compliance Certificates: AWI Quality Certification Program Certificates.

1.6 COORDINATION

A. A shop drawing coordination meeting shall be held before door, door frame, and door hardware shop drawings are submitted. The purpose of this meeting will be to coordinate doors, frames, door hardware, and electrical rough-ins. The Contractor shall notify the owner, designer, and affected subcontractors, and schedule the meeting. The electrical contractor shall prepare conduit and box rough-in drawings for each door/frame requiring electronic systems or other wiring and bring these drawings to the coordination meeting. The affected trades shall coordinate wiring, rough-ins, door opening construction, door frame and door hardware installation prior to the submission of door shop drawings or electrical rough-in.

1.7 QUALITY ASSURANCE

- A. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.
- B. Quality Standard: Comply with WDMA I.S.1-A, "Architectural Wood Flush Doors", AWI Sections 1300 and 1500 "Architectural Woodwork Quality Standards" whichever is more stringent.
- C. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies shall comply with qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:
 - 1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.
- D. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies shall comply with qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:
 - 1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in cardboard cartons, and wrap bundles of doors in plastic sheeting.
 - 1. Factory finished doors shall be individually wrapped in plastic sheeting bags to protect the finish from damage by contact with other doors. Doors shall be palletized at factory in stacks of no more than 30 doors per pallet. Door edges shall be protected with heavy corner guards.
- C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until building is enclosed and weathertight, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during remainder of construction period.
 - 1. And residual moisture from plaster, concrete, masonry or terrazzo work has dissipated.

1.10 WARRANTY

- A. Special Warranty (Full Door Warranty): Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship.
- B. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Delamination of veneer.
 - b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
 - c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
 - d. Or any other defect which limits or prevents to full and unhindered use of the door or which may, in any way, impair or affect performance of the door for the purpose which it is intended.
2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.
4. Warranty Period for Hollow-Core Interior Doors: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Wood Door and Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings and temperature-rise limits indicated on Drawings, based on testing at positive pressure in accordance with UL 10C or NFPA 252.
 1. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.
- B. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

2.2 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with ANSI/WDMA I.S. 1A.
 1. Provide labels and certificates from AWI certification program indicating that doors comply with requirements of grades specified.
 - a. Contractor shall register the Work under this Section with the AWI Quality Certification Program at www.awiqcp.org or by calling 855-345-0991.
 2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with the Contract Documents in addition to those of the referenced quality standard.
- B. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

- C. Composite Wood Products: Verify products are made using ultra-low-emitting formaldehyde resins, as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products," or are made with no added formaldehyde.
- D. **Quality Standard**: In addition to requirements specified, comply with AWI/AWMAC/WT's "Architectural Woodwork Standards." and ANSI/WDMA I.S. 1A. as specified.
 - 1. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with the Contract Documents in addition to those of the referenced quality standard.

2.3 **SOLID-CORE FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH**

A. **Interior Doors:**

- 1. **Manufacturers**: Subject to compliance with requirements, provide products by one of the following:
 - a. Lambton Doors.
 - b. Masonite Architectural.
 - c. Oshkosh Door Company.
 - d. VT Industries Inc.
 - e. Wilsonart LLC.
- 2. **Performance Grade**: ANSI/WDMA I.S. 1A Extra Heavy Duty.
- 3. **ANSI/WDMA I.S. 1A Grade**: Premium.
- 4. **Faces**: Single-ply wood veneer not less than 1/50 inch thick.
 - a. **Species**: Select white maple.
 - b. **Cut**: Plain sliced (flat sliced).
 - c. **Match between Veneer Leaves**: Slip match.
 - d. **Assembly of Veneer Leaves on Door Faces**: Running match.
 - e. **Pair and Set Match**: Provide for doors hung in same opening or separated only by mullions.
 - f. **Room Match**: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 20 feet or more.
 - g. **Room Match**: Provide door faces of compatible color and grain within each separate room or area of building.
- 5. **Exposed Vertical and Top Edges**: Same species as faces - Architectural Woodwork Standards edge Type A.
 - a. **Fire-Rated Single Doors**: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
 - b. **Fire-Rated Pairs of Doors**: Provide formed-steel edges and astragals with intumescent seals.
 - 1) Finish steel edges and astragals with baked enamel same color as doors.

- 2) Finish steel edges and astragals to match door hardware (locksets or exit devices).
 - c. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
- 1) Screw-Holding Capability: 475 lbf in accordance with WDMA T.M. 10.
6. Core for Non-Fire-Rated Doors:
 - a. WDMA I.S. 10 structural composite lumber.
 - b. Screw Withdrawal, Door Face: 550 lbf.
 - c. Screw Withdrawal, Vertical Door Edge: 550 lbf.
7. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.
 - a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as follows:
 - 1) 5-inch top-rail blocking.
 - 2) 5-inch bottom-rail blocking, in doors indicated to have protection plates.
 - 3) 5-inch midrail blocking, in doors indicated to have armor plates.
 - 4) 4-1/2-by-10-inch lock blocks or 5-inch midrail blocking, in doors indicated to have exit devices.
8. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.4 LIGHT FRAMES AND LOUVERS

- A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
 1. Wood Species: Same species as door faces.
 2. Profile: Manufacturer's standard shape.
 3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.
- B. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated on Drawings. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.
- C. Wood Louvers: Door manufacturer's standard solid-wood louvers unless otherwise indicated.
 1. Wood Species: Same species as door faces.
 2. Profile: Flat.

2.5 FABRICATION

- A. Factory machine doors for hardware that is not surface applied.
 - 1. Locate hardware to comply with DHI-WDHS-3.
 - 2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
 - 3. Coordinate with hardware mortises in frames, to verify dimensions and alignment before factory machining.
 - 4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
 - 5. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- B. Transom and Side Panels:
 - 1. Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors.
 - 2. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
 - 3. Fabricate door and transom panels with full-width, solid-lumber, rabbeted, meeting rails.
 - 4. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.
- C. Openings: Factory cut and trim openings through doors.
 - 1. Light Openings: Trim openings with moldings of material and profile indicated.
 - 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."
 - 3. Louvers: Factory install louvers in prepared openings.

2.6 FACTORY PRIMING

- A. Doors for Opaque Finish: Factory prime faces, all four edges, edges of cutouts, and mortises with one coat of wood primer specified in Section 099123 "Interior Painting."

2.7 FACTORY FINISHING

- A. Comply with referenced quality standard for factory finishing.
 - 1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 - 2. Finish faces, all four edges, edges of cutouts, and mortises.
 - 3. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors that are indicated on Drawings to receive transparent finish.
- C. Transparent Finish:
 - 1. ANSI/WDMA I.S. 1A Grade: Premium.

2. Finish: As selected by the Architect from the manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Section 087100 "Door Hardware."
- B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
- C. Install frames level, plumb, true, and straight.
 1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
 2. Anchor frames to anchors or blocking built in or directly attached to substrates.
 - a. Secure with countersunk, concealed fasteners and blind nailing.
 - b. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
 - 1) For factory-finished items, use filler matching finish of items being installed.
 3. Install fire-rated doors and frames in accordance with NFPA 80.
 4. Install smoke- and draft-control doors in accordance with NFPA 105.
- D. Job-Fitted Doors:
 1. Align and fit doors in frames with uniform clearances and bevels as indicated below.
 - a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.
 2. Machine doors for hardware.
 3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 4. Clearances:
 - a. Provide 1/8 inch at heads, jambs, and between pairs of doors.

- b. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
 - c. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
 - d. Comply with NFPA 80 for fire-rated doors.
- 5. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
- 6. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- F. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 FIELD QUALITY CONTROL

- A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Inspections:
 - 1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
 - 2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

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SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Access doors and frames.
 - 2. Fire-rated access doors and frames.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, fire ratings, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Product Schedule: For access doors and frames. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing and inspecting agency.
 - 1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
 - 2. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.

1.5 CLOSEOUT SUBMITTALS

- A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

1.6 QUALITY ASSURANCE

- A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies shall meet the qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection and temperature-rise limit ratings indicated, according to NFPA 252 or UL 10B.
 1. NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically.
 2. NFPA 288 for fire-rated access door assemblies installed horizontally.

2.2 ACCESS DOORS AND FRAMES

- A. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.
- B. Flush Access Doors with Concealed Flanges:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ACUDOR Products, Inc.
 - b. Babcock-Davis.
 - c. Cendrex Inc.
 - d. Milcor; a division of Hart & Cooley, Inc.
 - e. Nystrom.
 2. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
 3. Locations: Wall and ceiling.
 4. Door Size: As indicated on the Drawings.
 5. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage factory primed.
 6. Frame Material: Same material and thickness as door.
 7. Latch and Lock: Cam latch, screwdriver operated.
- C. Recessed Access Doors with Concealed Flanges:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ACUDOR Products, Inc.
 - b. Babcock-Davis.
 - c. Cendrex Inc.
 - d. Milcor; a division of Hart & Cooley, Inc.
 - e. Nystrom.

2. Description: Door face recessed 1/2 inch for gypsum board infill; with concealed flange for gypsum board installation and concealed hinge.
3. Locations: Wall and ceiling.
4. Door Size: As indicated on the Drawings.
5. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage, factory primed.
6. Latch and Lock: Cam latch, screwdriver operated.

2.3 FIRE-RATED ACCESS DOORS AND FRAMES

A. Fire-Rated, Flush Access Doors with Exposed Flanges: At CMU shaft walls.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ACUDOR Products, Inc.
 - b. Babcock-Davis.
 - c. Cendrex Inc.
 - d. Milcor; a division of Hart & Cooley, Inc.
 - e. Nystrom.
2. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal; with exposed flange, self-closing door, and concealed hinge.
3. Locations: Wall.
4. Door Size: As indicated on the Drawings.
5. Fire-Resistance Rating: Not less than that of adjacent construction.
6. Temperature-Rise Rating: 450 deg F at the end of 30 minutes.
7. Metallic-Coated Steel Sheet for Door: Nominal 0.040 inch, 20 gage, factory primed.
8. Frame Material: Same material, thickness, and finish as door.
9. Latch and Lock: Self-latching door hardware, operated by knurled-knob.

B. Fire-Rated, Flush Access Doors with Concealed Flanges: At gypsum board walls and ceilings.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ACUDOR Products, Inc.
 - b. Babcock-Davis.
 - c. Cendrex Inc.
 - d. Milcor; a division of Hart & Cooley, Inc.
 - e. Nystrom.
2. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal; with concealed flange for gypsum board installation, self-closing door, and concealed hinge.
3. Locations: Wall and ceiling.
4. Door Size: As indicated on the Drawings.
5. Fire-Resistance Rating: Not less than that of adjacent construction.
6. Temperature-Rise Rating: 450 deg F at the end of 30 minutes.
7. Metallic-Coated Steel Sheet for Door: Nominal 0.040 inch, 20 gage, factory primed.
8. Frame Material: Same material, thickness, and finish as door.

9. Latch and Lock: Self-closing, self-latching door hardware, operated by knurled-knob.

2.4 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.
- C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.
- D. Frame Anchors: Same material as door face.
- E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.5 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
 1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
- D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling. Provide access sleeves for each latch operator and install in holes cut through finish.
- E. Latch and Lock Hardware:
 1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.

2.6 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 FIELD QUALITY CONTROL

- A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Inspections:
 - 1. Fire-Rated Door Inspections: Inspect each fire-rated access door in accordance with NFPA 80, Section 5.2.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each fire-rated access door indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

SECTION 083613 - SECTIONAL DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Power-operated steel sectional-door assemblies at Apparatus Bays.
2. Power-operated aluminum full lite sectional-door assemblies at Apparatus Bays.

- B. Related Requirements:

1. Section 055000 "Metal Fabrications" for miscellaneous steel supports.
2. Section 099113 "Exterior Painting" for finish painting of factory-primed steel doors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type and size of sectional door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
2. For power-operated doors, include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

- B. Shop Drawings: For each installation and for components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. Include diagrams for power, signal, and control wiring.

- C. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard size.

- D. Samples for Initial Selection: For units with factory-applied finishes.

1. Include Samples of accessories involving color selection.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranties: For manufacturer's warranty and finish warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sectional doors to include in maintenance manuals.
- B. Manufacturer's warranty.
- C. Finish warranty.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
- B. Regulatory Requirements: Comply with provisions in the United States Access Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1 applicable to sectional doors.

1.7 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Failure of components or operators before reaching required number of operation cycles.
 - c. Faulty operation of hardware.
 - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
 - e. Delamination of exterior or interior facing materials.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

- A. Source Limitations: Obtain sectional doors from single source from single manufacturer.
 - 1. Obtain operators and controls from sectional door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Provide sectional doors that comply with performance requirements specified without failure from defective manufacture, fabrication, installation, or other defects in construction.
- B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
 - 1. Design Wind Load: As indicated on the Structural Drawings.
 - 2. Testing: In accordance with ASTM E330/E330M or DASMA 108 for garage doors and complying with DASMA 108 acceptance criteria.
 - 3. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components.
 - a. Deflection of door sections in horizontal position (open) shall not exceed 1/120 of door width.
 - b. Deflection of horizontal track assembly shall not exceed 1/240 of door height.

2.3 STEEL SECTIONAL-DOOR ASSEMBLY

- A. Steel Sectional Door: Provide sectional door formed with hinged sections and fabricated so that finished door assembly is rigid and aligned with tight hairline joints; free of warp, twist, and deformation; and complies with requirements in DASMA 102.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or comparable products as approved by the Architect:
 - a. C.H.I. Overhead Doors, Inc.
 - b. Martin Door Manufacturing.
 - c. Overhead Door Corporation.
 - d. Raynor.
 - e. Wayne-Dalton Corp.
- B. Steel Door Sections: ASTM A653/A653M, zinc-coated (galvanized), cold-rolled, commercial steel sheet with G60 zinc coating.
 - 1. Door-Section Thickness: 1-3/4 inches.
 - 2. Section Faces:
 - a. Thermal-Break Construction: Provide sections with continuous thermal-break construction separating the exterior and interior faces of door.

- b. Exterior Face: Fabricated from single sheets, not more than 24 inches high; with horizontal meeting edges rolled to continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove, weather- and pinch-resistant seals and reinforcing flange return.
 - 1) Steel Sheet Thickness: Manufacturer's standard thickness.
 - 2) Surface: Manufacturer's standard, paneled, as selected by the Architect.
 - c. Interior Face: Enclose insulation completely within steel exterior facing and interior facing material, with no exposed insulation. Provide the following interior-facing material:
 - 1) Zinc-Coated (Galvanized) Steel Sheet: With minimum nominal coated thickness dimension recommended in writing by manufacturer to comply with performance requirements.
 3. End Stiles: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet not less than 0.040-inch nominal coated thickness and welded to door section.
 4. Intermediate Stiles: Provide intermediate stiles formed from not less than 0.040-inch-thick galvanized-steel sheet, cut to door section profile, and welded in place. Space stiles not more than 48 inches apart.
 5. Section Reinforcing: Horizontal and diagonal reinforcement as required to stiffen door and for wind loading. Provide galvanized-steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place. Ensure that reinforcement does not obstruct vision lites.
 - a. Bottom Section: Reinforce section with a continuous channel or angle conforming to bottom-section profile and allowing installation of astragal (weatherseal).
 - b. Hardware Locations: Provide reinforcement for hardware attachment.
 6. Glazed Panels: Manufacturer's standard, aluminum-framed section with glazing sealed with glazing tape and steel glazing bead. Glazing as follows:
 - a. Insulating Glass Units: Manufacturers' standard unit with tempered glass lites complying with ASTM C1048, Kind FT (fully tempered), Condition A (uncoated), Type I, Class 1 (clear), Quality-Q3.
 7. Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard insulation of type indicated below:
 - a. Board Insulation: Polystyrene or polyurethane, secured to exterior face sheet.
 - b. Foamed-in-Place Insulation: Polyurethane, foamed in place to completely fill interior of section and pressure bonded to face sheets to prevent delamination under wind load.
 - c. Fire-Resistance Characteristics: Maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, in accordance with ASTM E84.
- C. Metal Finish: Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.

- a. Factory Prime Steel Finish: Compatible with field-applied finish and in manufacturer's standard color. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

2.4 ALUMINUM SECTIONAL- DOOR ASSEMBLY

- A. Aluminum Sectional Door: Provide sectional door formed with hinged sections and fabricated so that finished door assembly is rigid and aligned with tight hairline joints; free of warp, twist, and deformation; and complies with requirements in DASMA 102.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Overhead Door Corporation; 521 Series or comparable product by one of the following:
 - a. Clopay Building Products.
 - b. Wayne-Dalton Corp.
- B. Aluminum Sections: ASTM B221 extruded-aluminum stile and rail members of alloy and temper standard with manufacturer for type of use and finish indicated; in minimum thickness required to comply with requirements; with rail and stile dimensions and profiles indicated on Drawings; and with overlapped or interlocked weather- and pinch-resistant seal at meeting rails.
 1. Door-Section Thickness: 1-3/4 inches.
 2. Section Reinforcing: Continuous horizontal and diagonal reinforcement as required to stiffen door and for wind loading. Ensure that reinforcement does not obstruct vision lites.
 - a. Hardware Locations: Provide reinforcement for hardware attachment.
 3. Insulated Stiles and Rails: Fill stiles and rails manufacturer's standard polyurethane expanding foam.
 4. Glazed Panels: Manufacturer's standard, aluminum-framed section with glazing sealed with glazing tape and aluminum glazing bead. Glazing as follows:
 - a. Insulating Glass Units: Manufacturers' standard unit with tempered glass lites complying with ASTM C1048, Kind FT (fully tempered), Condition A (uncoated), Type I, Class 1 (clear), Quality-Q3.
 - 1) Thickness: 1/2 inch
- C. Metal Finish: Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
 1. Anodized Aluminum Finish: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
 - a. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

2.5 SECTIONAL DOOR GENERAL

- A. Operation Cycles: Door components and operators capable of operating for not less than 25,000 operation cycles. One operation cycle is complete when door is opened from closed position to the open position and returned to closed position.
- B. Air Infiltration: Maximum rate of 0.4 cfm/sq. ft. when tested in accordance with ASTM E283 or DASMA 105.

- C. Track: Manufacturer's standard, galvanized-steel, high-lift track system as indicated on the Drawings. Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides.
 - 1. Material: Galvanized steel, ASTM A653/A653M, minimum G60 zinc coating.
 - 2. Size: As recommended in writing by manufacturer for door size, weight, track configuration and door clearances indicated on Drawings.
 - 3. Track Reinforcement and Supports: Provide galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches apart for door-drop safety device.
 - a. Vertical Track: Incline vertical track to ensure weathertight closure at jambs. Provide continuous angle, continuous reverse angle, or intermittent jamb brackets attached to track and wall.
 - b. Horizontal Track: Provide continuous reinforcing angle from curve in track to end of track, attached to track and supported at points by laterally braced attachments to overhead structural members.
- D. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom, top, and jambs of door.
- E. Hardware: Heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless steel, or other corrosion-resistant fasteners, to suit door type.
 - 1. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch nominal coated thickness at each end stile and at each intermediate stile, in accordance with manufacturer's written recommendations for door size.
 - a. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is impossible.
 - b. Provide double-end hinges where required for doors more than 16 ft. wide unless otherwise recommended by door manufacturer in writing.
 - 2. Rollers: Heavy-duty rollers with steel ball bearings in case-hardened steel races, mounted to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Match roller-tire diameter to track width.
 - a. Roller-Tire Material: Case-hardened steel.
 - 3. Push/Pull Handles: Equip each door with galvanized-steel lifting handles on each side of door, finished to match door.
- F. Locking Device:
 - 1. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from inside only.
 - 2. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded deadbolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
 - a. Lock Cylinders: Cylinders standard with manufacturer.

- b. Keying: Keyed to building keying system.
 - c. Keys: Two for each cylinder.
 - 3. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.
- G. Counterbalance Mechanism:
- 1. Torsion Spring: Adjustable-tension torsion springs complying with requirements of DASMA 102 for number of operation cycles indicated, mounted on torsion shaft.
 - 2. Cable Drums and Shaft for Doors: Cast-aluminum cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised.
 - a. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft.
 - b. Provide one additional midpoint bracket for shafts up to 16 ft. long and two additional brackets at one-third points to support shafts more than 16 ft. long unless closer spacing is recommended in writing by door manufacturer.
 - 3. Cables: Galvanized-steel, multistrand, lifting cables with cable safety factor of at least 5 to 1.
 - 4. Cable Safety Device: Include a spring-loaded steel or bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if lifting cable breaks.
 - 5. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.
 - 6. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.
- H. Electric Door Operator: Electric door operator assembly of size and capacity recommended by door manufacturer for door and operation cycles specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
- 1. Comply with NFPA 70.
 - 2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with NFPA 70, Class 2 control circuit, maximum 24 V ac or dc.
 - 3. Safety: Listed in accordance with UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 ft. or lower.
 - 4. Usage Classification: Heavy duty, 25 or more cycles per hour and more than 90 cycles per day.
 - 5. Operator Type: Manufacturer's standard for door requirements.
 - 6. Motor: Reversible-type with controller (disconnect switch) for interior, clean, and dry motor exposure, unless exterior location is indicated. Use adjustable motor-mounting bases for belt-driven operators.
 - a. Motor Size: As required to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.

- b. Electrical Characteristics: As selected by the Architect from the manufacturer's full range.
- 7. Limit Switches: Equip motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- 8. Obstruction Detection: Automatic external entrapment protection consisting of automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel. Provide one of the following as selected by the Architect from the manufacturer's full range:
 - a. Monitored Entrapment Protection: Photoelectric sensor or electric sensor edge on bottom section designed to interface with door-operator control circuit to detect damage to or disconnection of sensor and complying with requirements in UL 325.
 - b. Unmonitored Entrapment Protection: Pneumatic sensor edge, black, located within weatherseal mounted to bottom bar or retro-reflective photo sensor.
- 9. Control Station: Flush or surface mounted, three-position (open, close, and stop) control.
 - a. Operation: Push button interior and key exterior.
 - b. Interior-Mounted Unit: Full-guarded, surface-mounted, standard-duty, weatherproof-type, NEMA ICS 6, Type 4 enclosure.
 - c. Exterior-Mounted Unit: Full-guarded, surface-mounted, standard-duty, weatherproof type, NEMA ICS 6, Type 4 Insert requirements enclosure.
 - d. Features: Provide the following:
 - 1) Vehicle detection operation.
 - 2) Radio-control operation.
- 10. Emergency Manual Operation: Push-up type designed so required force for door operation does not exceed 25 lbf.
- 11. Emergency Operation Disconnect Device: Hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- 12. Motor Removal: Design operator so motor can be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; in accordance with manufacturer's written instructions.
- B. Tracks:
 - 1. Fasten vertical track assembly to opening jambs and framing with fasteners spaced not more than 24 inches apart.
 - 2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.
- C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.
- D. Power-Operated Doors: Install automatic garage doors openers in accordance with UL 325.

3.3 STARTUP SERVICES

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks in accordance with manufacturer's written instructions.
 - 2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust doors and seals to provide weather-resistant fit around entire perimeter.
- D. Touchup Painting Galvanized Material: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A780/A780M.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION 083613

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SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Aluminum-framed storefront systems.
 - 2. Aluminum-framed entrance door systems.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
 - 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 - 2. Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
 - 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
 - 4. Include point-to-point wiring diagrams showing the following:
 - a. Power requirements for each electrically operated door hardware.

- b. Location and types of switches, signal device, conduit sizes, and number and size of wires.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
 - 1. Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.
 - 2. Provide one sample of typical fabricated section, showing joints, fastenings, quality of workmanship, hardware and accessory items before fabrication of the work proceeds.
- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- E. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.
- F. Delegated Design Submittal: For aluminum-framed entrances and storefronts including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data:
 - 1. For Installer and field testing agency.
 - 2. For professional engineer's experience with providing delegated design engineering services of the kind indicated, including documentation that engineer is licensed in the state in which Project is located.
- B. Source quality-control reports.
- C. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.
- B. Maintenance Data for Structural Sealant: For structural-sealant-glazed storefront to include in maintenance manuals. Include ASTM C1401 recommendations for post-installation phase quality control program.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer and that employs a qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors.

- B. Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated and acceptable to Owner and Architect.
- C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.
- D. Structural Sealant Glazing: Comply with ASTM C1401 for design and installation of storefront systems that include structural glazing.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Deterioration of metals and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.
 - e. Failure of operating components.
 - 2. Warranty Period: 10 years from date of Substantial Completion.
- B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Warranty Period: 20 years from date of Substantial Completion.
- C. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
 - 1. Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Delta E units when tested in accordance with ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D 4214.
 - c. Cracking, peeling, or chipping.
2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.
- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- C. Structural Loads:
 1. Wind Loads: As indicated on Structural Drawings.
 2. Other Design Loads: As indicated on Structural Drawings.
- D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:
 1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches.
 2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge

clearance between framing members and glazing or other fixed components to less than 1/8 inch.

- a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.
3. Cantilever Deflection: Limited to $2L/175$ at unsupported cantilevers.
- E. Structural: Test in accordance with ASTM E330/E330M as follows:
 1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
 2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- F. Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.6 at design displacement and 1.5 times the design displacement.
- G. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:
 1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
- H. Energy Performance at Exterior Assemblies: Certify and label energy performance according to National Fenestration Rating Council (NFRC) and in compliance with 2018 North Carolina State Energy Conservation Code as follows:
 1. Thermal transmittance (U-factor) at exterior assemblies: Provide door and frame assembly with a U-factor of not more than the following Btu/h x sq.ft. x deg F when tested according to ASTM C1363, NFRC 100 or AAMA 1503.
 - a. Fixed storefront U-factor: 0.45 maximum.
 - b. Non-entrance door U-factor: 0.45 maximum.
 - c. Entrance door (more than 50% glazing) U-factor: 0.77 maximum.
 2. Solar Heat Gain Coefficient: As required in Section 088000 "Glazing".
 3. Condensation Resistance Factor (CRF):
 - a. Fixed Glazing and Framing Areas: CRF for the system of not less than 35 as determined in accordance with AAMA 1503.
 - b. Entrance Doors: CRF of not less than 57 as determined in accordance with AAMA 1503.
- I. Noise Reduction: Test in accordance with ASTM E90, with ratings determined by ASTM E1332, as follows.

1. Outdoor-Indoor Transmission Class: Minimum 26, unless otherwise indicated.
- J. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.
 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- K. Thermal Cycling: No buckling, stress on glass, sealant failure, excess stress on framing, anchors and fasteners, or reduction of performance when tested according to AAMA 5015.
 1. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 def F.
 2. Low exterior Ambient Air Temperature: 0 deg. F
 3. Interior Ambient Air Temperature: 75 deg. F.
- L. Structural Sealant Joints:
 1. Designed to carry gravity loads of glazing.
- M. Structural Sealant: ASTM C1184, capable of withstanding tensile and shear stresses imposed by structural sealant glazed, aluminum framed entrances and storefronts without failings adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.
 1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
 2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant to substrate bond strength exceeds sealant's internal strength.
- N. Comply with requirements and recommendations of AAMA except where more stringent requirements are stated herein.

2.3 STOREFRONT SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following as approved by the Architect:
 1. EFCO Corporation.
 2. Kawneer North America, an Arconic company.
 3. Oldcastle BuildingEnvelope (OBE); CRH Americas.
 4. U.S. Aluminum; a brand of C.R. Laurence.
 5. YKK AP America Inc.
- B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 1. Exterior Framing Construction: Thermally broken.
 2. Interior Framing Construction: Nonthermal.
 3. Glazing System: Retained mechanically with gaskets on four sides.
 4. Glazing Plane: As shown in drawings.
 5. Finish:

- a. Superior-performance organic finish at interior and exterior, except clear anodic finish at interior Base Bid office entries.
 - b. Color: As selected by Architect from manufacture's full range including metallic and specialty colors.
- 6. Fabrication Method: Field-fabricated stick system.
- 7. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
- 8. Steel Reinforcement: As required by manufacturer.
- C. Backer Plates: Manufacturer's standard, continuous thermally broken aluminum backer plates for framing members, if not integral, where framing abuts adjacent construction. Backer plates may be omitted when framing extrusions have continuous, integral backs.
- D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- E. Sills: Provide high-performance sills.
- F. Water Deflectors: Provide water deflectors within the framing system.

2.4 ENTRANCE DOOR SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following as approved by the Architect:
 - 1. EFCO Corporation.
 - 2. Kawneer North America, an Arconic company.
 - 3. Nana Wall Systems, Inc.
 - 4. Oldcastle BuildingEnvelope (OBE); CRH Americas.
 - 5. U.S. Aluminum; a brand of C.R. Laurence.
 - 6. YKK AP America Inc.
- B. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.
 - 1. Door Construction: 1 3/4-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
 - a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
 - 2. Door Design: Wide stile; 5-inch nominal width, unless otherwise indicated.
 - 3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.
 - 4. Finish: Match adjacent storefront framing finish.

2.5 GLAZING

- A. Glazing: Comply with Section 088000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
- C. Glazing Sealants: As recommended by manufacturer.
- D. Structural Glazing Sealants: ASTM C1194 chemically curing silicone formulation that is compatible with system components with which it comes in contact; specifically formulated and tested for use as structural sealant and approved by structural sealant manufacturer for use in storefront system indicated.
 - 1. Color: As selected by Architect from manufacturer's full range of colors.

2.6 MATERIALS

- A. Sheet and Plate: ASTM B209.
- B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
- C. Structural Profiles: ASTM B308/B308M.
- D. Steel Reinforcement:
 - 1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
 - 2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
 - 3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.
- E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.

2.7 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2. Reinforce members as required to receive fastener threads.
 - 3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system, fabricated from 300 series stainless steel.
- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.
- C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.

2.8 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
 1. Profiles that are sharp, straight, and free of defects or deformations.
 2. Accurately fitted joints with ends coped or mitered.
 3. Physical and thermal isolation of glazing from framing members.
 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 5. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Structural Sealant Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.
- F. Storefront Framing: Fabricate components for assembly using head-and-sill-receptor system with shear blocks at intermediate horizontal members.
- G. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
 1. At interior and exterior doors, provide compression weather stripping at fixed stops.
- H. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
 1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
 2. At exterior doors, provide weather sweeps applied to door bottoms.
- I. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

- J. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.9 ALUMINUM FINISHES

- A. Superior-Performance Organic Finish, Three-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Color and Gloss: As selected by Architect from manufacturer's full range

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Comply with manufacturer's written instructions.
- B. Do not install damaged components.
- C. Do not install until the air barrier system is installed and approved by the architect.
- D. Fit joints to produce hairline joints free of burrs and distortion.
- E. Rigidly secure nonmovement joints.
- F. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- G. Seal perimeter and other joints watertight unless otherwise indicated.
- H. Metal Protection:
 - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
 - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- I. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.

- J. Install joint filler behind sealant as recommended by sealant manufacturer.
- K. Install components plumb and true in alignment with established lines and grades.
- L. Install high-performance sills and water deflectors according to manufacturer's written instructions.

3.3 INSTALLATION OF GLAZING

- A. Install glazing as specified in Section 088000 "Glazing."

3.4 INSTALLATION OF WEATERSEAL SEALANT

- A. After structural sealant has completely cured, remove temporary retainers, and insert backer rod between lites of glass as recommended by sealant manufacturer.
- B. Install weather seal sealant to completely fill cavity, according to sealant manufacturer's written instructions, to produce weatherproof joints.

3.5 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE DOORS

- A. Install entrance doors to produce smooth operation and tight fit at contact points.
 - 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
 - 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware in accordance with entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.6 ERECTION TOLERANCES

- A. Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
 - 1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
 - 2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
 - 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
 - 4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts.
 - 1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested in accordance with AAMA 501.2 and shall not evidence water penetration.
 - a. Perform a minimum of three tests in areas as directed by Architect.
 - 2. Air Leakage: ASTM E783 at not more than 0.09 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
 - a. Perform a minimum of three tests in areas as directed by Architect.
 - 3. Water Penetration: ASTM E1105 at a minimum uniform and cyclic static-air-pressure differential of not less than 6.24 lbf/sq. ft., and shall not evidence water penetration.
- C. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.8 MAINTENANCE SERVICE

- A. Entrance Door Hardware Maintenance:
 - 1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.
 - 2. Initial Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Use parts and supplies that are the same as those used in the manufacture and installation of original equipment.

END OF SECTION 084113

SECTION 08 44 13 – GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Glazed aluminum curtain wall systems for louvers.
 - a. Conventionally glazed.

- B. Related Requirements:

- 1. Division 07 Section "Joint Sealants" for installation of joint sealants installed with glazed aluminum curtain walls and for sealants to the extent not specified in this Section.
 - 2. Division 08 Section "Aluminum-Framed Entrances and Storefronts" for interior entrances.
 - 3. Division 08 Section "Glazing" for curtain wall glazing.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Attend conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

- B. Sustainable Design Submittals:

- 1. Product Data: For sealants, indicating VOC content.
 - 2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

- C. Shop Drawings: For glazed aluminum curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.

- 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 - 2. Include full-size isometric details of each type of vertical-to-horizontal intersection of glazed aluminum curtain walls, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.

- d. Glazing.
 - e. Flashing and drainage.
- 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

D. Samples for Initial Selection: For units with factory-applied color finishes.

E. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

F. Delegated-Design Submittal: For glazed aluminum curtain walls, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

- 1. Curtain wall depths shown in Drawings are based on preliminary calculations. Depth of curtain wall is to be as required to meet structural performance requirements, but must be at least the depth indicated in the Drawings.

G. Manufacturer's written installation instructions.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data:

- 1. For Installer and laboratory mockup testing agency.
- 2. For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the state in which Project is located.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified preconstruction testing agency, for glazed aluminum curtain walls, indicating compliance with performance requirements.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For glazed aluminum curtain walls to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating glazed aluminum curtain walls that meet or exceed energy performance requirements indicated and of documenting this performance by certification, labeling, and inclusion in lists.

B. Installer Qualifications: Capable of assuming engineering responsibility and performing type and extent of Work outlined in this Section, who is acceptable to manufacturer and has been in continuous business as an established Glazing Contractor for a minimum of five years

C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.
- D. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code-Aluminum."

1.8 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for glazed aluminum curtain-wall systems by field measurements before fabrication and indicate measurements on Shop Drawings.
 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating glazed aluminum curtain-wall systems without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.9 WARRANTY

- A. Special Assembly Warranty: Manufacturer agrees to repair or replace components of glazed aluminum curtain wall that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.
 - e. Failure of operating components.
 2. Warranty Period: 10 years from date of Substantial Completion.
- B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of baked enamel, powder coat, or organic finishes within specified warranty period.
 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 1. Glazed aluminum curtain walls shall withstand movements of supporting structure, including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.

2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- B. Structural Loads:
 1. Wind Loads: As indicated on Drawings.
 2. Other Design Loads: As indicated on Drawings.
- C. Deflection of Framing Members: At design wind pressure, as follows:
 1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to **13 feet 6 inches** and to 1/240 of clear span plus **1/4 inch** for spans of greater than **13 feet 6 inches** or an amount that restricts edge deflection of individual glazing lites to **3/4 inch**, whichever is less.
 2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than **1/8 inch**.
 3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:
 - a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus **1/4-inch** for spans of greater than **11 feet 8-1/4 inches** or 1/175 times span, for spans of less than **11 feet 8-1/4 inches**.
- D. Structural: Test in accordance with ASTM E330/E330M as follows:
 1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- E. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:
 1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than **10 lbf/sq. ft.**
- F. Interstory Drift: Accommodate design displacement of adjacent stories indicated.
 1. Design Displacement: 15% of the story height of the below component.
 2. Test Performance: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.4 at design displacement and 1.5 times the design displacement.
- G. Seismic Performance: Glazed aluminum curtain walls shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.
 1. Vertical Interstory Movement: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.7 at design displacement and 1.5 times the design displacement.

H. Energy Performance: Certified and labelled by manufacturer for energy performance as follows:

1. Thermal Transmittance (U-factor):
 - a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.46 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.
2. Solar Heat Gain Coefficient (SHGC):
 - a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.25 as determined in accordance with NFRC 200.
3. Air Leakage:
 - a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than at a static-air-pressure differential of 6.24 lbf/sq. ft. when tested in accordance with ASTM E283.
4. Condensation Resistance Factor (CRF):
 - a. Fixed Glazing and Framing Areas: CRF for the system of not less than 59 as determined in accordance with AAMA 1503.

I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested in accordance with AAMA 501.5.
 - a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
 - b. Low Exterior Ambient-Air Temperature: 0 deg F 120 deg F.

2.2 SOURCE LIMITATIONS

- A. Obtain all components of curtain-wall system, including framing spandrel panels, sun control and accessories, from single manufacturer.

2.3 GLAZED ALUMINUM CURTAIN WALL SYSTEMS

1. Basis-of-Design Product: Subject to compliance with requirements, provide YKK AP America Inc., YCW750OG, or comparable product by one of the following:
 - a. EFCO Corporation.
 - b. Kawneer North America, an Arconic company.
 - c. Oldcastle Building Envelope.
 - d. Wausau Window and Wall Systems; Apogee Wausau Group, Inc.
- B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 1. Construction: Thermally broken.
 2. Glazing System: Retained mechanically with gaskets on four sides.
 3. Glazing Plane: As shown in drawings.
 4. Finish: Superior-performance organic finish.
 5. Fabrication Method: Either factory- or field-fabricated system.
 6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 7. Steel Reinforcement: As required by manufacturer.
 8. Size:
 - a. 6 inches x 2-1/2 inches at louvers indicated on Drawings to be glazed into curtain wall.

- C. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.
 - 1. Include snap-on aluminum trim that conceals fasteners.
- D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.4 GLAZING

- A. Glazing: Comply with Section 08 80 00 "Glazing."
- B. Glazing Gaskets: ASTM C509 or ASTM C864. Compression-type, replaceable EPDM.
 - 1. Color: Black.
- C. Glazing Sealants: Comply with Section 08 80 00 "Glazing."
 - 1. Verify sealant has a VOC content of 250 g/L or less.
 - 2. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.5 MATERIALS

- A. Sheet and Plate: ASTM B209.
- B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
- C. Extruded Structural Pipe and Tubes: ASTM B429/B429M.
- D. Structural Profiles: ASTM B308/B308M.
- E. Steel Reinforcement:
 - 1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
 - 2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
 - 3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.
- F. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.

2.6 ACCESSORIES

- A. Custom Aluminum Sill Flashing: Provide custom aluminum sill flashing, installed under and in addition to manufacturer's sill framing.
 - 1. Minimum thickness: 0.040 inch.
 - 2. Location: Where indicated on drawings.
 - 3. Finish: Match curtain wall framing.
 - 4. Hem all edges where exposed to view after installation.

- B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2. Reinforce members as required to receive fastener threads.
 - 3. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended by manufacturer.
 - 4. All fasteners to be stainless steel if exposed to water including internal and if attaching to wood.
- C. Anchors: Three-way adjustable anchors with minimum adjustment of **1 inch** that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
 - 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.
- D. Concealed Flashing: As indicated in section 07 62 00 "Sheet Metal Flashing and Trim."
- E. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for **30-mil** thickness per coat.
- F. Snap covers to conceal pressure plates. Snap covers to have a minimum of 2 weeps on underside.

2.7 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 5. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
 - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Fabricate components to resist water penetration as follows:
 - 1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
 - 2. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.
- E. Curtain-Wall Framing: Fabricate components for assembly using shear-block system.

- F. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.8 ALUMINUM FINISHES

- A. Superior-Performance Organic Finish, Three-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Color and Gloss: As selected by Architect from manufacturer's full range

2.9 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Confirm adjacent walls have been constructed within tolerances that allow proper installation of the curtainwalls before setting frames.
- B. Proceed with installation only after unsatisfactory conditions have been corrected and air barrier system has been installed and approved by architect.

2.10 INSTALLATION, GENERAL

- A. Comply with manufacturer's written instructions.
- B. Do not install damaged components.
- C. Fit joints to produce hairline joints free of burrs and distortion.
- D. Rigidly secure nonmovement joints.
- E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- F. Where welding is required, weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
- G. Seal joints watertight unless otherwise indicated.
- H. Metal Protection:
 - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
 - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- I. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

1. Provide shims, blocks or other means for providing positive drainage to the exterior whether shown in the drawings or not.
- J. Set continuous sill members and flashing in full sealant bed as specified in Division 07 Section "Joint Sealants" and to produce weathertight installation. At fastener heads that penetrate sub-sill flashing, cover fastener heads with sealant.
- K. Glaze louvers specified in Division 08 Section "Fixed Louvers" into curtain wall framing as recommended by curtain wall and louver manufacturers.
- L. Install components plumb and true in alignment with established lines and grades.
- M. Install sealants as specified in Division 07 Section "Joint Sealants."
- N. Install glazing as specified in Division 08 Section "Glazing."
- O. All fasteners for securing pressure bars to be torqued as defined in installation manual for specific product.

2.11 ERECTION TOLERANCES

- A. Install glazed aluminum curtain walls to comply with the following maximum tolerances:
 1. Plumb: **1/8 inch in 10 feet; 1/4 inch in 40 feet.**
 2. Level: **1/8 inch in 20 feet; 1/4 inch in 40 feet.**
 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to **1/2 inch** wide, limit offset from true alignment to **1/16 inch.**
 - b. Where surfaces are separated by reveal or protruding element from **1/2 to 1 inch** wide, limit offset from true alignment to **1/8 inch.**
 - c. Where surfaces are separated by reveal or protruding element of **1 inch** wide or more, limit offset from true alignment to **1/4 inch.**
 4. Location: Limit variation from plane to **1/8 inch in 12 feet; 1/2 inch** over total length.

2.12 CLEANING

- A. Post-Installation: Clean the completed system, inside and out, promptly after erection and installation of glass and sealants, allowing for normal curing time of liquid sealants. Clean surfaces promptly after installation of frames, exercising care to avoid damage to the finish. The installer to advise the Contractor of proper and adequate procedures for protection and cleaning during the remainder of the construction period so that the system will be without damage and deterioration at the time of acceptance.
- B. Final Cleaning: At the time of Substantial Completion, clean curtain wall system thoroughly and polish glass. Demonstrate proper cleaning methods and materials to the Owner's maintenance personnel.

2.13 FIELD QUALITY CONTROL

- A. Test Area: Perform tests on representative areas of glazed aluminum curtain walls.
- B. Field Quality-Control Testing: Perform the following test on representative areas of glazed aluminum curtain walls.

1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested in accordance with AAMA 501.2 and shall not evidence water penetration.
 - a. Perform a minimum of three tests in areas as directed by Architect.
 - b. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to 10, 35, and 70 percent completion.
- C. Tests must be performed before interior sealants and wall finishes have been installed
- D. Tests must be performed in the presence of the Owner's Project Manager and Building Envelope Consultant.
- E. Curtainwall installer to provide labor for access and testing of the installation. CM to provide min 30 psi water and hose.
- F. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.
- G. Prepare test and inspection reports.

END OF SECTION 08 44 13

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Mechanical door hardware for the following:
 - a. Swinging doors.
 - 2. Cylinders for door hardware specified in other Sections.
 - 3. Electrified door hardware.

1.3 COORDINATION

- A. Floor- Recessed Door Hardware: Coordinate layout and installation with floor construction.
 - 1. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.
- E. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Conference participants shall include Installer's Architectural Hardware Consultant and Owner's security consultant.

B. Keying Conference: Conduct conference at Project site.

1. Conference participants shall include Installer's Architectural Hardware Consultant and Owner's security consultant.
2. Incorporate conference decisions into keying schedule after reviewing door hardware keying system including, but not limited to, the following:
 - a. Flow of traffic and degree of security required.
 - b. Preliminary key system schematic diagram.
 - c. Requirements for key control system.
 - d. Requirements for access control.
 - e. Address for delivery of keys.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Details of electrified door hardware, indicating the following:

1. Wiring Diagrams: For power, signal, and control wiring and including the following:
 - a. Details of interface of electrified door hardware and building safety and security systems.
 - b. Schematic diagram of systems that interface with electrified door hardware.
 - c. Point-to-point wiring.
 - d. Risers.
 - e. Elevations doors controlled by electrified door hardware.
2. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.

C. Samples for Initial Selection: For plastic protective trim units in each finish, color, and texture required for each type of trim unit indicated.

D. Samples for Verification: For exposed door hardware of each type required, in each finish specified, prepared on Samples of size indicated below. Tag Samples with full description for coordination with the door hardware schedule. Submit Samples before, or concurrent with, submission of door hardware schedule.

1. Sample Size: Full-size units or minimum 2-by-4-inch (51-by-102-mm) Samples for sheet and 4-inch (102-mm) long Samples for other products.
 - a. Full-size Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.

E. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Submittal Sequence: Submit door hardware schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work (e.g.,

hollow metal frames) which is critical in the project construction schedule. The Contractor's attention shall be drawn to the lead time required for delivery of certain hardware items and the required date of Completion.

2. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
 3. Content: Include the following information:
 - a. Identification number, location, hand, fire rating, size, and material of each door and frame.
 - b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
 - c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
 - d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.
 - e. Fastenings and other installation information.
 - f. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
 - g. Mounting locations for door hardware.
 - h. List of related door devices specified in other Sections for each door and frame.
- F. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and Architectural Hardware Consultant.
- B. Product Certificates: For each type of electrified door hardware.
 1. Certify that door hardware for use on each type and size of labeled fire-rated doors complies with listed fire-rated door assemblies.
- C. Product Test Reports: For compliance with accessibility requirements, for tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.
- D. Field quality-control reports.
- E. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of door hardware to include in maintenance manuals.
- B. Schedules: Final door hardware and keying schedule.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Door Hardware: Types and quantities as approved by the Owner.
 - 2. Electrical Parts: Types and quantities as approved by the Owner.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.
 - 1. Warehousing Facilities: In Project's vicinity.
 - 2. Scheduling Responsibility: Preparation of door hardware and keying schedule.
 - 3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as an Architectural Hardware Consultant (AHC).

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.
- D. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.11 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.
- E. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.
- F. A shop drawing coordination meeting shall be held before door, door frame, and door hardware shop drawings are submitted. The purpose of this meeting will be to coordinate doors, frames, door hardware, and electrical rough-ins. The Contractor shall notify the owner, designer, and affected subcontractors, and schedule the meeting. The electrical contractor shall prepare conduit and box rough-in drawings for each door/frame requiring electronic systems or other wiring and bring these drawings to the coordination meeting. The affected trades shall coordinate wiring, rough-ins, door opening construction, door frame and door hardware installation prior to the submission of door shop drawings or electrical rough-in.
- G. Install one door for review by Owner and Architect to establish standard for installation of remaining doors.

1.12 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.
 - b. Faulty operation of doors and door hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 - 2. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:
 - a. Electromagnetic and Delayed-Egress Locks: Five years from date of Substantial Completion.
 - b. Exit Devices: Two years from date of Substantial Completion.
 - c. Manual Closers: 10 years from date of Substantial Completion.
 - d. Concealed Floor Closers: Five years from date of Substantial Completion.

1.13 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

a.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of door hardware from single manufacturer.
 - 1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
- B. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that complies with requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
 - 1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. at the tested pressure differential of 0.3-inch wg of water.
- C. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
- E. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the United States Access Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
 - 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
 - 2. Comply with the following maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
 - b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 - 3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
 - 4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.
 - 5. Adjust spring hinges so that, from an open position of 70 degrees, the door will take at least 1.5 seconds to move to the closed position.

2.3 HINGES

- A. Basis of Design Product: Subject to compliance with requirements, provide Ives or a comparable product by one of the following:
 - 1. Hager
 - 2. McKinney
- B. Hinges: BHMA A156.1. Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.
- C. Screws: Furnish Phillips flat-head all-purpose or machine screws for installation of units, except furnish Phillips flat-head all-purpose or wood screws for installation of units into wood. Finish screw heads to match surface of hinges or pivots.
- D. Hinges shall be full mortise, unless otherwise indicated, 5 knuckle type with plain-bearings except for doors with closers, corridor doors, doors over 36" wide where ball bearing hinges shall be used. Use heavy duty hinges with non-removable pins at exterior doors and outswinging storage doors.
- E. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - 1. Steel Hinges: Steel pins.
 - 2. Non-ferrous Hinges: Stainless steel pins.
 - 3. Exterior Doors: Continuous Hinges with non-removable pins
- F. Number of hinges: Provide number of hinges indicated but not less than 3 hinges for door leaf for doors 90" or less in height and one additional hinge for each 30" of additional height.

2.4 MECHANICAL LOCKS AND LATCHES

- A. Basis of Design Product: Subject to compliance with requirements, provide Schage or a comparable product by one of the following:
 - 1. Sargent.
 - 2. Best.
- B. Lock Functions: As indicated in door hardware schedule.
- C. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
 - 1. Mortise Locks: Minimum 3/4-inch latchbolt throw.
 - 2. Deadbolts: Minimum 1-inch bolt throw.
- D. Lock Backset: 2-3/4 inches unless otherwise indicated.
- E. Lock Trim:
 - 1. Levers: Cast.
 - 2. Knobs: Wrought.
 - 3. Dummy Trim: Match lever or knob lock trim and escutcheons.
 - 4. Operating Device: Lever with escutcheons (roses)

- F. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
 - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 - 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 - 3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
 - 4. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.
- G. Mortise Locks: BHMA A156.13; Operational and Security Grade 1; stamped steel case with steel or brass parts; Series 1000.
- H. Push-Pull Latches: Mortise, BHMA A156.13; Grade 1; with paddle handles that retract latchbolt; capable of being mounted vertically or horizontally.
 - 1. Through-bolted for matched pairs.

2.5 ELECTRIC STRIKES

- A. Electric Strikes: BHMA A156.31; Grade 1; with faceplate to suit lock and frame.

2.6 ELECTROMAGNETIC LOCKS

- A. Electromagnetic Locks: BHMA A156.23; electrically powered; with electromagnet attached to frame and armature plate attached to door; full-exterior or full-interior type, as required by application indicated.

2.7 ELECTROMECHANICAL LOCKS

- A. Electromechanical Locks: BHMA A156.25; Grade 1; motor or solenoid driven; mortise latchbolt; with strike that suits frame.

2.8 EXIT LOCKS AND EXIT ALARMS

- A. Exit Locks and Alarms: BHMA A156.29, Grade 1.

2.9 SURFACE BOLTS

- A. Surface Bolts: BHMA A156.16.

2.10 MANUAL FLUSH BOLTS

- A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.

2.11 AUTOMATIC AND SELF-LATCHING FLUSH BOLTS

- A. Automatic Flush Bolts: BHMA A156.3, Type 25; minimum 3/4-inch throw; with dust-proof strikes; designed for mortising into door edge.

2.12 EXIT DEVICES AND AUXILIARY ITEMS

- A. Basis of Design Product: Subject to compliance with requirements, provide VonDuprin or a comparable product by one of the following:
 - 1. Preciosion.
 - 2. Sargent
- B. Exit Devices and Auxiliary Items: BHMA A156.3.
- C. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
- D. Removable Mullions: BHMA A156.3.
- E. Outside Trim: Pull with cylinder; material and finish to match locksets, unless otherwise indicated.
 - 1. Match design for locksets and latchsets, unless otherwise indicated.

2.13 LOCK CYLINDERS

- A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver. Provide cylinder from same manufacturer of locking devices.
- B. Standard Lock Cylinders: BHMA A156.5; Grade 1 permanent cores; face finished to match lockset.
- C. High-Security Lock Cylinders: BHMA A156.30; Grade 1 permanent cores that are removable; face finished to match lockset.
- D. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.
- E. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.14 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, appendix. Provide one extra key blank for each lock. Incorporate decisions made in keying conference.
 - 1. Grand Master Key System: Change keys, a master key, and a grand master key operate cylinders.
 - a. Provide three cylinder change keys and five each of master and grand master keys.

2. Keyed Alike: Key all cylinders to same change key.

B. Keys: Nickel silver.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
 - a. Notation: "DO NOT DUPLICATE."

2.15 KEY CONTROL SYSTEM

- A. Key Control Cabinet: BHMA A156.28; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, two sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.
 1. Wall-Mounted Cabinet: Grade 1 cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.

2.16 OPERATING TRIM

- A. Operating Trim: BHMA A156.6; aluminum unless otherwise indicated.

2.17 ACCESSORIES FOR PAIRS OF DOORS

- A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release; and with internal override.
- B. Carry-Open Bars: BHMA A156.3; prevent the inactive leaf from opening before the active leaf; provide polished brass or bronze carry-open bars with strike plate for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.
- C. Astragals: BHMA A156.22.

2.18 SURFACE CLOSERS

- A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

2.19 CLOSER HOLDER RELEASE DEVICES

- A. Closer Holder Release Devices: BHMA A156.15; Grade 1; closer connected with separate or integral releasing and fire- or smoke-detecting devices. Door shall become self-closing on

interruption of signal to release device. Automatic release is activated by smoke detection system, loss of power.

2.20 MECHANICAL STOPS AND HOLDERS

- A. Wall- and Floor-Mounted Stops: BHMA A156.16.

2.21 OVERHEAD STOPS AND HOLDERS

- A. Overhead Stops and Holders: BHMA A156.8.

2.22 DOOR GASKETING

- A. Basis of Design Product: Subject to compliance with requirements, provide Pemko or a comparable product by one of the following:
 - 1. National Guard Products.
 - 2. Reese Enterprises, Inc.
- B. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
 - 1. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.
 - 2. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
 - 3. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.
 - 4. Provide interlocking compressible gaskets at all hollow kerfed metal door frames.

2.23 THRESHOLDS

- A. Basis of Design Product: Subject to compliance with requirements, provide Pemko or a comparable product by one of the following:
 - 1. Hager.
 - 2. National Guard Products.
- B. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.
- C. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 1/2 inch (13 mm) high.
- D. Provide flat single piece thresholds, ADA compatible, where scheduled at interior doors.
- E. Provide thermal break thresholds, ADA compatible, at exterior doors.
- F. Set exterior thresholds on a bed of sealant.

2.24 METAL PROTECTIVE TRIM UNITS

- A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch-thick aluminum; with manufacturer's standard machine or self-tapping screw fasteners.

2.25 AUXILIARY DOOR HARDWARE

- A. Auxiliary Hardware: BHMA A156.16.
- B. Silencers for Metal Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum diameter 1/2 inch (13 mm); fabricated for drilled-in application to frame.

2.26 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.
 - 1. Manufacturer's identification is permitted on rim of lock cylinders only.
- B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.
- C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.
 - 1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
 - 2. Fire-Rated Applications:
 - a. Wood or Machine Screws: For the following:
 - 1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames.
 - 2) Strike plates to frames.
 - 3) Closers to doors and frames.
 - b. Steel Through Bolts: For the following unless door blocking is provided:
 - 1) Surface hinges to doors.
 - 2) Closers to doors and frames.
 - 3) Surface-mounted exit devices.

3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
4. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
5. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.27 FINISHES

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.
- B. Provide matching finishes for hardware units at each door or opening, to the greatest extent possible, and except as otherwise indicated. Reduce differences in color and textures as much as commercially possible where the base metal or metal forming process is different for individual units of hardware exposed at the same door or opening. In general, match items to the manufacturer's standard finish for the latch and lockset (or push-pull units if no latch-lock sets) for color and texture.
 1. Provide finishes which match those established by BHMA or, if none established, match the Architect's sample.
 2. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness and other qualities complying with manufacturer's standards, but in no case less than specified for the applicable units of hardware by referenced standards.
 3. Provide protective lacquer coating on all exposed hardware finishes of brass, bronze and aluminum, except as otherwise indicated. The suffix "-NL" is used with standard finish designations to indicate "no lacquer".
 4. The designations used in schedules and elsewhere to indicate hardware finishes are those listed in "Materials & Finishes Standard 1301" by BHMA, including coordination with the traditional U.S. finishes shown by certain manufacturers for their products.
 5. Standard finish for all hardware shall be US26D (Dull Chrome).
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Provide field test by licensed and certified testing agency to inspect and certify existing door assemblies meet required rating. Provide door and frame labels certifying rating requirements are met.

3.2 PREPARATION

- A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
- B. Wood Doors: Comply with door and hardware manufacturers' written instructions.

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights indicated on Drawings and to comply with the following unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Custom Steel Doors and Frames: HMMA 831.
 - 3. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule, but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches of door height greater than 90 inches.
- E. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Replace construction cores with permanent cores as directed by Owner.
 - 2. Furnish permanent cores to Owner for installation.

F. Key Control System:

1. Key Control Cabinet: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

G. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, in equipment room. Verify location with Architect.

1. Configuration: Provide one power supply for each door opening with electrified door hardware.

H. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."

I. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

J. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

1. Do not notch perimeter gasketing to install other surface-applied hardware.

K. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

L. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
2. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 70 degrees and so that closing time complies with accessibility requirements of authorities having jurisdiction.
3. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

- B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.7 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

3.8 DEMONSTRATION

- A. Engage Installer to train Owner's maintenance personnel to adjust, operate, and maintain door hardware.

3.9 DOOR HARDWARE SCHEDULE

- A. Basis of Design Products: Subject to compliance with requirements, provide products scheduled below or a comparable product by one of the manufacturers listed above in Section 2 of this specification, in the corresponding paragraph for each type of hardware.
- B. Hardware Sets:

Set 1 – Entry Doors (100.1, 100.2)

1 Continuous Hinge	A110 HD C 100	AL	ABH
1 Exit Device	QEL RX CON 26 LD99-NL-OP 3'	626	VON DUPRIN
1 Rim Cylinder	12E-72	626	BEST
1 Door Pull	RM 201 6HD	US32D	ROCKWOOD
1 Closer	4111 S CUSH 30 SHOE SUPPORT	AL	LCN
10Brush Sweep	18100	CBN	PEMKO
1 Mullion Gasket	5110	BL	PEMKO
1 Threshold	158A	AL	PEMKO

Set 2 - Single Exterior Door (108.1, 108.7, 108.8)

3 Hinges	FBB199 4 ½" X 4 ½"	SP313	STANLEY
1 Exit Device	QEL RX CON 26 LD99-LNL-996/03 3'	626	VON DUPRIN

1 Rim Cylinder	12 E-72 STD	626	BEST
1 Closer	4111 S CUSH	AL	LCN
1 Rain Drip	346	C	PEMKO
1 Brush Sweep	18100 CBN	AL	PEMKO
1 Threshold	2727A 36"	AL	PEMKO
1 Threshold Stop Strip	1842_SA 36"	AL	PEMKO
Kerf-in Weatherstrip	S109_100	D	PEMKO
2 Kick Plate	K1050F 10X34	US32D316	ROCKWOOD

Set 3 – Electrical Room (111)

3 Hinges	FBB199 4 ½" X 4 ½"	SP313	STANLEY
1 Exit Device	LD99-LNL-996/03 3'	626	VON DUPRIN
1 Rim Cylinder	12 E-72 STD	626	BEST
1 Closer	4111 S CUSH	AL	LCN
1 Rain Drip	346	C	PEMKO
1 Brush Sweep	18100 CBN	AL	PEMKO
1 Threshold	2727A 36"	AL	PEMKO
1 Threshold Stop Strip	1842_SA 36"	AL	PEMKO
Kerf-in Weatherstrip	S109_100	D	PEMKO
2 Kick Plate	K1050F 10X34	US32D316	ROCKWOOD

Set 4 – Sectional Doors (108.2, 108.3, 108.4, 108.5, 108.6, 108.9, 108.10, 108.11, 108.12, 108.13)**Set 5 – Toilet Room (101A)**

3 Hinges	FBB199 4 ½" X 4 ½"	32D	STANLEY
1 Lockset	45H 0 L 3R VIN	626	BEST
1 Wall stop	426	US32D	ROCKWOOD
3 Silencers	608	GRAY	ROCKWOOD
1 Kick Plate	K1050F 10X34	US32D316	ROCKWOOD

Set 6 – Decon Shower (105)

3 Hinges	FBB199 4 ½" X 4 ½"	32D	STANLEY
1 Lockset	45H 7 L 3R VIN	626	BEST
1 Overhead stop	10 4 S ADJ	US32D	GLYNN JOHNSON
3 Silencers	608	GRAY	ROCKWOOD
1 Kick Plate	K1050F 10X34	US32D316	ROCKWOOD

Set 7 – Storage (109, 110, 112, M001)

3 Hinges	FBB199 4 ½" X 4 ½"	32D	STANLEY
1 Lockset	45H 7 D 3R	626	BEST
1 Wall stop	426	US32D	ROCKWOOD
3 Silencers	608	GRAY	ROCKWOOD
1 Kick Plate	K1050F 10X34	US32D316	ROCKWOOD

Set 8 – Gear Storage (102.1)

3 Hinges	FBB199 4 ½” X 4 ½”	32D	STANLEY
1 Lockset	45H 7 N 3R	626	BEST
1 Closer	4011 REG	AL	LCN
3 Silencers	608	GRAY	ROCKWOOD
1 Kick Plate	K1050F 10X34	US32D316	ROCKWOOD

Set 9 – Gear Storage (102.2)

3 Hinges	FBB199 4 ½” X 4 ½”	32D	STANLEY
1 Lockset	45H 7 N 3R	626	BEST
1 Closer	4111 S CUSH	AL	LCN
3 Silencers	608	GRAY	ROCKWOOD
1 Kick Plate	K1050F 10X34	US32D316	ROCKWOOD

Set 10 – Decon (106.2)

4 Hinges	FBB199 4 ½” X 4 ½”	32D	STANLEY
1 Exit Device	LD99-LNL-626-4’-996/03	626	VON DUPRIN
1 Rim Cylinder	12 E-72 STD	626	BEST
1 Closer	4111 S CUSH	AL	LCN
1 Brush Sweep	18100 CBN	AL	PEMKO
1 Threshold	2727A 48”	AL	PEMKO
1 Threshold Stop Strip	1842_SA 48”	AL	PEMKO
Kerf-in Weatherstrip	S109_100	D	PEMKO

Set 11 – Decon (104.3, 106.1, 106.3)

4 Hinges	FBB199 4 ½” X 4 ½”	32D	STANLEY
1 Exit Device	LD99-LNL-626-4’-996/03	626	VON DUPRIN
1 Rim Cylinder	12 E-72 STD	626	BEST
1 Closer	4011 H	AL	LCN
1 Brush Sweep	18100 CBN	AL	PEMKO
1 Threshold	2727A 48”	AL	PEMKO
1 Threshold Stop Strip	1842_SA 48”	AL	PEMKO
Kerf-in Weatherstrip	S109_100	D	PEMKO

Set 12 – Transition Vestibule (104.1, 107.1)

3 Hinges	FBB199 4 ½” X 4 ½”	32D	STANLEY
1 Exit Device	LD99-L-BE-626-3’-996/03	626	VON DUPRIN
1 Closer	4011 H	AL	LCN
3 Silencers	608	GRAY	ROCKWOOD
1 Kick Plate	K1050F 10X34	US32D316	ROCKWOOD

Set 13–Transition Vestibule (104.2, 107.2)

3 Hinges	FBB199 4 ½” X 4 ½”	32D	STANLEY
1 Exit Device	QEL RX CON 26 LD99-NL-OP 3’	626	VON DUPRIN
1 Rim Cylinder	12 E-72 STD	626	BEST

1 Closer	4111 S CUSH	AL	LCN
1 Brush Sweep	18100 CBN	AL	PEMKO
1 Threshold	2727A 36"	AL	PEMKO
1 Threshold Stop Strip	1842_SA 36"	AL	PEMKO
Kerf-in Weatherstrip	S109_100	D	PEMKO
1 Kick Plate	K1050F 10X34	US32D316	ROCKWOOD

Set 14– Exit Door (107.3)

3 Hinges	FBB199 4 ½" X 4 ½"	SP313	STANLEY
1 Exit Device	LD99-LNL-996/01 3'	626	VON DUPRIN
1 Closer	4111 S CUSH	AL	LCN
1 Rain Drip	346	C	PEMKO
1 Brush Sweep	18100 CBN	AL	PEMKO
1 Threshold	2727A 36"	AL	PEMKO
1 Threshold Stop Strip	1842_SA 36"	AL	PEMKO
Kerf-in Weatherstrip	S109_100	D	PEMKO
Kick Plate	K1050F 10X34	US32D316	ROCKWOOD

Coordinate products in each door hardware set with products specified in Part 2. Do not duplicate the requirements specified in Part 2.

END OF SECTION 087100

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SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Glass products.
 - 2. Insulating glass.
 - 3. Glazing sealants.
 - 4. Glazing tapes.
 - 5. Miscellaneous glazing materials.

1.3 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.
- C. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

1.4 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.5 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

- A. Delegated Design: Design glass, including comprehensive engineering analysis according to ASTM E 1300 by a qualified professional engineer, licensed in the State of North Carolina, using the following design criteria:
 - 1. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.
 - a. Wind Design Data: As indicated on Drawings.
 - 2. Design Snow Loads: As indicated on Drawings.
 - 3. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
 - 4. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch (25 mm), whichever is less.
 - 5. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
- C. Glazing Accessory Samples: For sealants and colored spacers, in 12-inch lengths. Install sealant Samples between two strips of material representative in color of adjoining framing system.
- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- E. Delegated Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, manufacturers of fabricated glass units, glass testing agency, and sealant testing agency.
- B. Product Certificates: For glass and glazing products, from manufacturer, signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
- C. Product Test Reports: For fabricated glass and glazing sealants, for tests performed by a qualified testing agency.

1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
- D. Preconstruction adhesion and compatibility test report.
- E. Sample Warranties: For special warranties.

1.8 QUALITY ASSURANCE

- A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved and certified by primary glass manufacturer.
- B. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors.
- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.
- E. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
 1. Install glazing in mockups specified in Section 084113 "Aluminum-Framed Entrances and Storefronts" to match glazing systems required for Project, including glazing methods.
 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.9 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
 2. Use ASTM C1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 4. Schedule enough time for testing and analyzing results to prevent delaying the Work.

5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.

B. Preinstallation Conference: Attend conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review temporary protection requirements for glazing during and after installation.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.11 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.12 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.
1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Glass: Obtain each glass type from single source from single manufacturer.
- B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.
- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:
 - 1. Design Wind Pressures: As indicated on Structural Drawings.
 - 2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
 - 3. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.
- D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 - 1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
 - 2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 - 3. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.
 - 4. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
 - 5. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

F. Acoustic Performance:

1. Exterior Glazing: OITC as selected by the Architect.
2. Interior Glazing: STC as selected by the Architect.

2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. NGA Publications: "Glazing Manual."
 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.
1. Minimum Glass Thickness for Exterior Lites: 6 mm.
 2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
- E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
- B. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- C. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

2.5 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.

1. Sealing System: Dual seal, with polyisobutylene and silicone primary and secondary sealants.
2. Perimeter Spacer: As selected by the Architect from the manufacturer's full range.
3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.6 GLAZING, GENERAL

- A. Provide glazing materials and methods required for products and installations listed herein. All glazing to be compatible with materials and methods and to provide performance required for systems and warranties.

- B. GLAZING GASKETS

1. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
 - a. EPDM, ASTM C 864.
 - b. Silicone, ASTM C 1115.
 - c. Thermoplastic polyolefin rubber, ASTM C 1115.
2. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene, EPDM, silicone or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
3. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.
4. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.7 GLAZING SEALANTS

- A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

3. Colors of Exposed Glazing Sealants: As selected by the Architect from the manufacturer's full range.
- B. Neutral-Curing Silicone Glazing Sealant, Class 100/50: Complying with ASTM C920, Type S, Grade NS, Use NT.

2.8 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
 1. AAMA 804.3 tape, where indicated.
 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.9 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Type recommended in writing by sealant or glass manufacturer.
- D. Spacers: Type recommended in writing by sealant or glass manufacturer.
- E. Edge Blocks: Type recommended in writing by sealant or glass manufacturer.
- F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.10 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product

manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 2. Presence and functioning of weep systems.
 3. Minimum required face and edge clearances.
 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch-minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.

- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.

- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 MONOLITHIC GLASS SCHEDULE

- A. Clear Glass Type: Annealed float glass.
 - 1. Minimum Thickness: 6 mm.
 - 2. Fully tempered where required with safety glazing labeling.

3.9 INSULATING GLASS SCHEDULE

- A. Low-E-Coated, Clear Insulating Glass Type:
 - 1. Basis-of-Design Product: As selected by the Architect.
 - 2. Overall Unit Thickness: 1 inch.
 - 3. Minimum Thickness of Each Glass Lite: 6 mm.
 - 4. Outdoor Lite: Annealed float glass, unless fully tempered is required.
 - 5. Interspace Content: Argon.
 - 6. Indoor Lite: Annealed float glass, unless fully tempered is required.
 - 7. Low-E Coating: Pyrolytic on second surface.
 - 8. Winter Nighttime U-Factor: 0.29 maximum
 - 9. Summer Daytime U-Factor: 0.27 maximum
 - 10. Solar Heat Gain Coefficient: 0.25 maximum
 - 11. Fully tempered where required with safety glazing labeling.

END OF SECTION 088000

SECTION 089119 - FIXED LOUVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Fixed extruded-aluminum louvers.
- B. Related Requirements:
 - 1. Section 76200 "Sheet Metal Flashing and Trim" for flashing.
 - 2. Section for masonry.

1.3 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades (i.e., the axis of the blades are horizontal).
- C. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven-rain performance, as determined by testing according to AMCA 500-L.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
 - 1. Show weep paths, gaskets, flashings, sealants, and other means of preventing water intrusion.
 - 2. Show mullion profiles and locations.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 WARRANTY

- A. Special Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.
 - 1. Deterioration includes, but is not limited to, the following:
 - a. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain fixed louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer licensed to practice in the State of North Carolina, using structural and seismic performance requirements and design criteria indicated.
- B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

1. Wind Loads: Determine loads based on pressures as indicated on Drawings.
- C. Seismic Performance: As indicated on drawings.
- D. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 1. Temperature Change (Range): 120 deg F , ambient; 180 deg F , material surfaces .
- F. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.3 FIXED EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal, Wind-Driven-Rain-Resistant Louver:
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Greenheck Fan Corporation "Curtain Wall Glazing Adapted Louver."
 - b. Ruskin Company Labor Savers " Flush Glazing Frame Louver."
 - c. Safe Air - Dowco Products "Architectural Window / Curtain Wall Glazing Adapter Louver."
 2. Louver Depth: 4 inches .
 3. Frame and Blade Nominal Thickness: Not less than 0.080 inch .
 4. Louver Performance Ratings:
 - a. Free Area: 50%
 - b. Air Performance: Not more than 0.25-inch static pressure drop at 1,300-fpm free-area exhaust and intake velocity.
 - c. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rainfall rate of 8 inches per hour and a wind speed of 50 mph at a core-area intake velocity of 600 fpm .
 5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.4 LOUVER SCREENS

- A. General: Provide screen at each exterior louver .
 1. Screen Location for Fixed Louvers: Interior face.
 2. Screening Type: Bird screening .
- B. Secure screen frames to louver frames with stainless-steel machine screws , spaced a maximum of 6 inches from each corner and at 12 inches o.c.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

1. Metal: Same type and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
2. Finish: Same finish as louver frames to which louver screens are attached .
3. Type: Rewirable frames with a driven spline or insert .

D. Louver Screening for Aluminum Louvers:

1. Bird Screening: Aluminum, **1/2-inch-** square mesh, **0.063-inch** wire.
2. Insect Screening: Aluminum, **18-by-16** mesh, **0.012-inch** wire.

2.5 MATERIALS

- A. Aluminum Extrusions: **ASTM B 221** , Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: **ASTM B 209** , Alloy 3003 or 5005, with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Use types and sizes to suit unit installation conditions.
 1. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

2.6 FABRICATION

- A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
 1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern unless horizontal mullions are indicated .
- C. Maintain equal louver blade spacing , including separation between blades and frames at head and sill, to produce uniform appearance.
- D. Fabricate louver to be glazed into curtainwall framing, specified in Division 08 “Glazed Aluminum Curtainwall”.
- E. Include supports, anchorages, and accessories required for complete assembly.

2.7 ALUMINUM FINISHES

- A. Finish louvers after assembly.

- B. Superior-Performance Organic Finish, Three-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Color and Gloss: As selected by Architect from manufacturer's full range

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

- A. Locate and install louvers in curtainwall frames.
- B. Form closely fitted joints with exposed connections accurately located and secured.
- C. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

3.4 ADJUSTING AND CLEANING

- A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers damaged during installation and construction, so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 089119

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Non-load-bearing steel framing systems for interior partitions.
 - 2. Suspension systems for interior ceilings and soffits.
 - 3. Grid suspension systems for gypsum board ceilings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of code-compliance certification for studs and tracks.
- B. Evaluation Reports: For embossed, high-strength steel studs and tracks, firestop tracks, post-installed anchors, and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.
- C. Horizontal Deflection: For composite or non-composite wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 5 lbf/sq. ft., unless otherwise indicated.

2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C645 requirements for steel unless otherwise indicated.
 - 2. Protective Coating: ASTM A653/A653M, G40, hot-dip galvanized unless otherwise indicated.
- B. Studs and Tracks: ASTM C645. Use either conventional steel studs and tracks or embossed, high-strength steel studs and tracks.
 - 1. Steel Studs and Tracks:
 - a. Minimum Base-Steel Thickness: 0.033 inch
 - b. Depth: As indicated on Drawings.
- C. Slip-Type Head Joints: Where indicated, provide one of the following:
 - 1. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- D. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 - 1. Minimum Base-Steel Thickness: 0.0179 inch.
- F. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-steel thickness, with minimum 1/2-inch-wide flanges.
 - 1. Depth: As indicated on Drawings.
 - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.
- G. Hat-Shaped, Rigid Furring Channels: ASTM C645.
 - 1. Minimum Base-Steel Thickness: 0.033 inch.
 - 2. Depth: As indicated on Drawings.
- H. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission.
 - 1. Configuration: Asymmetrical or hat shaped.
- I. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.
 - 1. Depth: As indicated on Drawings.
 - 2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch.

3. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.
- J. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-steel thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.
- B. Hanger Attachments to Concrete:
 1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
 - a. Type: Postinstalled, expansion anchor.
- C. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- D. Angle Hangers: ASTM A 653/A 653M, G60, hot-dip galvanized commercial-steel sheet.
 - a. Minimum Base Metal Thickness: 0.033 inch (0.84 mm).
 - b. Size: 2 by 2 inches.
- E. Furring Channels (Furring Members):
 1. Steel Studs and Tracks: ASTM C645.
 - a. Minimum Base-Steel Thickness: 0.033 inch, unless otherwise required for structural performance.
 - b. Depth: As indicated on Drawings.

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
 1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
- B. Coordination with building components:
 - 1. Review installation requirements including locations, heights and spacing for electrical, mechanical, plumbing, structural and other building components prior to installation of steel framing. Layout and install steel framing in locations to accommodate all required building components including required clearances.
 - 2. Remove and reinstall steel framing components that interfere with required locations of other building components. Install framing to comply with other steel framing installation requirements including member sizes and spacing.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C754.
 - 1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C841 that apply to framing installation.
 - 2. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

- F. Coordinate framing locations to accommodate installation of all recessed fixtures and devices.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Single-Layer Application: As required by horizontal deflection performance requirements unless otherwise indicated.
 - 2. Multilayer Application: As required by horizontal deflection performance requirements unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
 - 1. Slip-Type Head Joints: Install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 - 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- E. Direct Furring:
 - 1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

- F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING CEILING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Hangers: 48 inches o.c., unless otherwise required for structural performance.
 - 2. Carrying Channels (Main Runners): 48 inches o.c. , unless otherwise required for structural performance.
 - 3. Furring Channels (Furring Members): 16 inches or 24 inches o.c. as indicated on the Drawings and as required for structural performance.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 - 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 4. Do not attach hangers to steel roof deck.
 - 5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 - 6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 - 7. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

- G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

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SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Interior gypsum board.
- 2. Tile backing panels.

- B. Related Requirements:

- 1. Section 079219 "Acoustical Joint Sealants" for acoustical joint sealants installed in gypsum board assemblies.
- 2. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:

- 1. Gypsum wallboard.
- 2. Gypsum board, Type X.
- 3. Gypsum ceiling board.
- 4. Abuse-resistant gypsum board.
- 5. Mold-resistant gypsum board.
- 6. Gypsum board, Type C.
- 7. Glass-mat, water-resistant backing board.
- 8. Cementitious backer units.
- 9. Interior trim.
- 10. Aluminum trim.
- 11. Joint treatment materials.
- 12. Sound-attenuation blankets.

- B. Samples: For the following products:

- 1. Trim Accessories: Full-size Sample in 12-inch-long length for each trim accessory indicated.

1.4 QUALITY ASSURANCE

- A. Mockups: Build mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Build mockups for the following:
 - a. Each level of gypsum board finish indicated for use in exposed locations.
 - 2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
 - 3. Simulate finished lighting conditions for review of mockups.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Gypsum Wallboard: ASTM C1396/C1396M.
 - 1. Thickness: 5/8 inch, unless otherwise indicated.
 - 2. Long Edges: Tapered.
- B. Gypsum Board, Type X: ASTM C1396/C1396M.
 - 1. Thickness: 5/8 inch, unless otherwise indicated.
 - 2. Long Edges: Tapered.
- C. Gypsum Ceiling Board: ASTM C1396/C1396M.
 - 1. Thickness: 5/8 inch, unless otherwise indicated.
 - 2. Long Edges: Tapered.
- D. Abuse-Resistant Gypsum Board: ASTM C1396/C1396M gypsum board, tested according to ASTM C1629/C1629M.
 - 1. Core: 5/8 inch
 - 2. Surface Abrasion: ASTM C1629/C1629M, meets or exceeds Level 2 requirements.
 - 3. Indentation: ASTM C1629/C1629M, meets or exceeds Level 2 requirements.
 - 4. Soft-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 2 requirements.
 - 5. Long Edges: Tapered.
 - 6. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.
- E. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.
 - 1. Core: 5/8 inch, Type X
 - 2. Long Edges: Tapered.
 - 3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.4 SPECIALTY GYPSUM BOARD

- A. Gypsum Board, Type C: ASTM C1396/C1396M. Manufactured to have increased fire-resistive capability.
 - 1. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
 - 2. Long Edges: Tapered.

2.5 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.
 - 1. Thickness: 5/8 inch, unless otherwise indicated.
 - 2. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.6 TRIM ACCESSORIES

- A. Interior Trim: ASTM C1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
 - 2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. L-Bead: L-shaped; exposed long flange receives joint compound.
 - d. Expansion (control) joint: Use where indicated but not more than 30 feet on center at walls, ceilings and soffits at continuous surface areas. See other location requirements in the Documents.
 - e. J-Molding: Gypsum wall board depth, extruded 6063 T5 aluminum, clear anodized finish, Fry Reglet JDM-X, or approved equal, where indicated on the Drawings
- B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Fry Reglet Corporation.
 - b. Gordon, Inc.
 - c. Pittcon Industries.
 - 2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B221 (ASTM B221M), Alloy 6063-T5.
 - a. Reveal: Gypsum wall board depth by width indicated, Fry Reglet Reveal DRM-X-625, or approved equal.
 - b. F-Reveal: Gypsum wall board depth by width, Fry Reglet F Reveal DRMF-X-625.
 - 3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.7 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C475/C475M.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.

- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 - 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
 - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound or high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.
- D. Joint Compound for Exterior Applications:
 - 1. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.
- E. Joint Compound for Tile Backing Panels:
 - 1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.8 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
 - 1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- C. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Thickness: Match Stud Depth.
 - 2. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- D. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."
- E. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

- A. Comply with ASTM C840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Maintain ¼" gap between the bottom of the panel and the concrete floor slab for sealant.
- E. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- F. Form control and expansion joints with space between edges of adjoining gypsum panels.
- G. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.
- H. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 3/8-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- I. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

- J. Attach gypsum panels to resilient furring channels such that fastener does not reach framing or substrate on which resilient furring channel is attached.
- K. Attach gypsum panels to framing provided at openings and cutouts.
- L. At partitions called to be sealed to deck that are not fire-rated assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- M. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.
- N. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- O. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.
- P. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.
 - 1. Space screws a maximum of 12 inches o.c. for vertical applications.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Wallboard Type: Vertical surfaces unless otherwise indicated.
 - 2. Type X: Where required for fire-resistance-rated assembly and as indicated on Drawings.
 - 3. Ceiling Type: Ceiling surfaces.
 - 4. Abuse-Resistant Type: As indicated on Drawings.
 - 5. Mold-Resistant Type: At wet wall locations.
 - 6. Type C: Where required for specific fire-resistance-rated assembly indicated.
 - 7. Glass-Mat Interior Type: As indicated on Drawings.
- B. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

- a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws where required for fire-resistance-rated assemblies.

- D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.4 INSTALLATION OF TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A108.11.

3.5 INSTALLATION OF TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners unless otherwise indicated.

2. LC-Bead: Use at exposed panel edges.
3. L-Bead: Use where gypsum wall board abuts other materials.

3.6 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 2. Level 2: Panels that are substrate for tile, panels that are substrate for acoustical tile and where indicated on Drawings.
 3. Level 3: Where indicated on Drawings.
 4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
- E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or blotchy surface contamination and discoloration.

3.8 FIELD QUALITY CONTROL

- A. Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, Architect will conduct above-ceiling observation and report discrepancies in the Work observed. Do not

proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.

1. Notify Architect ten working days in advance of date and time when Project or part of Project will be ready for above ceiling observation.
2. Before notifying Architect complete the following in areas to receive gypsum board ceilings.
 - a. Installation of lighting fixtures.
 - b. Installation, insulation and leak-proof testing of water piping systems.
 - c. Installation of air-duct and mechanical piping systems and required testing.
 - d. Installation of devices.
 - e. Installation of all ceiling support framing.
 - f. Installation of other building components required by other Specification Sections or Contract Drawings.

END OF SECTION 092900

SECTION 093000 - TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Floor tile.
 - 2. Wall tile.
 - 3. Thresholds.
 - 4. Waterproof membranes.
 - 5. Crack isolation membranes.
 - 6. Metal edge strips.

- B. Related Requirements:

- 1. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
 - 2. Section 092900 "Gypsum Board" for cementitious backer units and glass-mat, water-resistant backer board.

1.3 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. Face Size: Actual tile size, excluding spacer lugs.
- C. Module Size: Actual tile size plus joint width indicated.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples for Initial Selection: For tile, grout, and accessories involving color selection.

D. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.
2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.
3. Full-size units of each type of trim and accessory for each color and finish required.
4. Stone thresholds in 6-inch lengths.
5. Metal edge strips in 6-inch lengths.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of product.
- C. Product Test Reports: For tile-setting and -grouting products.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
 2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Comply with one of the following:
 1. Installer is a Five-Star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.
 2. Installer's supervisor for Project holds the International Masonry Institute's Foreman Certification.
 3. Installer employs only Ceramic Tile Education Foundation Certified Installers or installers recognized by the U.S. Department of Labor as Journeyman Tile Layers for Project.
 4. Installer employs at least one installer for Project that has completed the Advanced Certification for Tile Installers (ACT) certification for installation of mud floors, mud walls, membranes, shower receptors, gauged porcelain tile/gauged porcelain tile panels and slabs, and large format tile.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of each type of floor tile installation.
2. Build mockup of each type of wall tile installation.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.
 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
 1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
 2. Obtain waterproof membrane and crack isolation membrane, except for sheet products, from manufacturer of setting and grouting materials.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:
 1. Stone thresholds.
 2. Waterproof membrane.
 3. Crack isolation membrane.

4. Metal edge strips

2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard grade requirements unless otherwise indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
 - 1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

2.3 TILE PRODUCTS

- A. Tile Type : T2
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Daltille “Mosaic Keystones in Black D311” or comparable product from one of the following:
 - a. Tile Bar
 - b. Roca Tile
 - 2. Composition: Porcelain .
 - 3. Certification: Porcelain tile certified by the Porcelain Tile Certification Agency.
 - 4. Module Size: 2"x2"
 - 5. Thickness: 1/4 inch
 - 6. Face: Pattern of design indicated, with cushion edges.
 - 7. Surface: Smooth, without abrasive admixture.
 - 8. Dynamic Coefficient of Friction: Not less than 0.42.
 - 9. Finish: Matte
 - 10. Tile Color and Pattern: To match Basis-of-Design in both color and pattern .
 - 11. Grout Color: Match Basis-of-Design in Finishes Legend .
 - 12. Grout Line Width: 1/8".
 - 13. Tile Base: Provide Tile Cove Base from same line and manufacturer. Architect to select profile from Manufacturers full range.
- B. Tile Type : T4

1. Basis-of-Design Product: Subject to compliance with requirements, provide Roca “Magnolia in Blanco 88MAGBLA618” or comparable product from one of the following:
 - a. Tile Bar
 - b. Daltile
2. Composition: Ceramic
3. Module Size: 6"x18"
4. Thickness: 8 mm
5. Face: Pattern of design indicated, with cushion edges.
6. Surface: Smooth, without abrasive admixture.
7. Finish: Matte
8. Tile Color and Pattern: To match Basis-of-Design in both color and pattern .
9. Grout Color: Match Basis-of-Design in Finishes Legend .
10. Grout Line Width: 1/8".

C. Tile Type : T5

1. Basis-of-Design Product: Subject to compliance with requirements, provide Roca “Color Collection in Black Bright U759” or comparable product from one of the following:
 - a. Tile Bar
 - b. Daltile
2. Composition: Ceramic
3. Module Size: 3"x6"
4. Thickness: 1/4 inch
5. Face: Pattern of design indicated, with cushion edges.
6. Surface: Smooth, without abrasive admixture.
7. Finish: Matte
8. Tile Color and Pattern: To match Basis-of-Design in both color and pattern .
9. Grout Color: Match Basis-of-Design in Finishes Legend .
10. Grout Line Width: 1/8".

2.4 THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
 1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.
- B. Marble Thresholds: ASTM C503/C503M, with a minimum abrasion resistance of 10 according to ASTM C1353 or ASTM C241/C241M and with honed finish.
 1. Description:
 - a. Uniform, fine- to medium-grained stone. Color to be selected by Architect from manufacturers full range.

2.5 GALVANIZED MESH REINFORCEMENT

- A. Galvanized Steel Reinforcement: Provide 1-1/2-inch by 1-1/2-inch galvanized steel mesh reinforcement were indicated in showers and ADA shower rooms.

2.6 WATERPROOF MEMBRANES

- A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric.
 - 1. Manufacturers: Subject to compliance with requirements, undefined:
 - a. Noble Company (The); Chloraloy .
 - b. Oatey, CPE Shower Pan Liner.
 - 2. Nominal Thickness: 0.040 inch.
- C. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Laticrete 9235 Waterproof Membrane by Laticrete International, Inc. or comparable product by one of the following:
 - a. Custom Building Products
 - b. MAPEI Corporation
 - c. Summitville Tiles, Inc.

2.7 SETTING MATERIALS

- A. Modified Dry-Set Mortar (Thinset): ANSI A118.4.
 - 1. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.
- B. Portland Cement Mortar (Thickset/Mudbed) Installation Materials: ANSI A108.02.
 - 1. Cleavage Membrane: Asphalt felt, ASTM D226/D226M, Type I (No. 15); or polyethylene sheeting, ASTM D4397, 4.0 mils thick.
 - 2. Reinforcing Wire Fabric: Galvanized, welded-wire fabric, 2 by 2 inches by 0.062-inch diameter; comply with ASTM A185/A185M and ASTM A82/A82M, except for minimum wire size.
 - 3. Latex Additive: acrylic resin **[or]** water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.
- C. Water-Cleanable, Tile-Setting Epoxy: ANSI A118.3.
 - 1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F, respectively, and certified by manufacturer for intended use.

- D. Organic Adhesive: ANSI A136.1, Type I.

2.8 GROUT MATERIALS

- A. Standard Cement Grout: ANSI A118.6.
- B. High-Performance Tile Grout: ANSI A118.7.

- 1. Polymer Type:

- a. Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.
 - b. Acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.

- C. Water-Cleanable Epoxy Grout: ANSI A118.3.

- 1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F, respectively, and certified by manufacturer for intended use.

- D. Grout for PregROUTed Tile Sheets: Same product used in factory to pregROUT tile sheets.

2.9 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

- B. Vapor-Retarder Membrane: Polyethylene sheeting, ASTM D4397, 4.0 mils thick.

- C. Metal Edge Strips: Profile designed for wall terminations and edge protection.

- 1. Manufacturers, but not limited to:
 - a. Schluter
 - b. Custom Building Products
 - c. Koffler
- 2. Description: J-shaped, unless otherwise indicated on Drawings.
- 3. Material and Finish: Polished nickel anodized aluminum exposed-edge material.

- D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

- E. Floor Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.

2.10 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - 2. Verify that concrete substrates for tile floors installed with adhesives, bonded mortar bed, or thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
 - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 - 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 - 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION OF TILE

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
 - 1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
 - a. Tile floors in wet areas.
 - b. Tile floors in laundries.
 - c. Tile floors consisting of tiles 8 by 8 inches or larger.
 - d. Tile floors consisting of rib-backed tiles.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
- F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 - 2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - 3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- G. Joint Widths: Provide width as approved by the Architect.
- H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

- I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- J. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
 - 1. Do not extend cleavage membrane, waterproof membrane, or crack isolation membrane under thresholds set in modified dry-set mortar. Fill joints between such thresholds and adjoining tile set on cleavage membrane, waterproof membrane, or crack isolation membrane with elastomeric sealant.
- K. Metal Edge Strips: Install at locations indicated and where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.
- L. Floor Sealer: Apply floor sealer to grout joints in tile floors according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 INSTALLATION OF TILE BACKING PANELS

- A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use modified dry-set mortar for bonding material unless otherwise directed in manufacturer's written instructions.

3.5 INSTALLATION OF WATERPROOF MEMBRANES

- A. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
- B. Allow waterproof membrane to cure and verify by testing that it is watertight before installing tile or setting materials over it.

3.6 INSTALLATION OF CRACK ISOLATION MEMBRANES

- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
- B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

3.7 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.8 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.9 INTERIOR TILE INSTALLATION SCHEDULE

- A. Interior Floor Installations, Concrete Subfloor:
 - 1. TCNA F113: Thinset mortar.
 - a. Thinset Mortar: Modified dry-set mortar, unless otherwise indicated.
 - b. Grout: Standard unsanded cement grout, unless otherwise indicated.
- B. Interior Wall Installations, Solid Backing:
 - 1. TCNA W222 Method **ANSI A108.1A**. One-coat cement mortar bed (thickset) installed on solid backing.
 - 2. Insert drawing designation from Part 2. Check with manufacturer to confirm that tile complies with ASTM C650 for chemical resistance needed.
 - 3. Retain one thinset mortar from options in “Bond Coat for Cured-Bed Method” Subparagraph below if retaining ANSI A108.1B or ANSI A108.1C in “TCNA W222” Subparagraph above; delete subparagraph below if retaining ANSI A108.1A.
 - a. Bond Coat for Cured-Bed Method: **Dry-set** mortar.
 - b. Grout: Water-cleanable epoxy.

- c. Waterproof Membrane: **Polyethylene sheet**
- d. Joint Width: **1/4 inch**

END OF SECTION 093000

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes acoustical panels and exposed suspension systems for interior ceilings.
- B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.
- C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
 - 1. Acoustical Panel: Set of 6-inch-(150mm-) square Samples of each type, color, pattern and texture.
 - 2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch-(150-mm-) long Samples of each type, finish, and color.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.
- C. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.
- D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Ceiling Units: Full-size panels; 1 unopened carton of each type.
 - 2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

1.7 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockup of typical ceiling area as shown on Drawings.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.10 COORDINATION

- A. Coordinate layout and installation of acoustical panels, coffer units and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Colors, Textures, and Patterns: Refer to Drawing Sheets I-000 for Interior Finishes Legend and for Interior Finishes Plans. The Interior Finishes Plan identifies Basis of Design products for the purpose of establishing colors, patterns and percentages of field and accent colors. The Basis of Design products do not preclude the use of products by other acceptable manufacturers provided all requirements and specifications are met.

2.2 MANUFACTURERS

- A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.3 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Class A according to ASTM E1264.
 - 2. Smoke-Developed Index: 50 or less.
- B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL or from the listings of another qualified testing agency.

2.4 ACOUSTICAL PANELS - **ACT1**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide **Armstrong World Industries, Inc.; Ultima Tegular 1911** or comparable product by one of the following:
 - 1. CertainTeed Corp.
 - 2. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
 - 1. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2, water felted; with membrane.
 - 2. Pattern: E (lightly textured).
- C. Color: White.
- D. LR: Not less than 0.90.
- E. NRC: Not less than 0.70.

- F. CAC: Not less than 35.
- G. Edge/Joint Detail: Beveled, tegular.
- H. Thickness: 3/4 inch.
- I. Modular Size: 24 by 24 inches.
- J. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.5 ACOUSTICAL PANELS – ACT2

- A. Basis-of-Design Product: Subject to compliance with requirements, provide **Armstrong World Industries, Inc.; Ceramaguard Square Lay-In 605** or comparable product by one of the following:
 - 1. CertainTeed Corp.
 - 2. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
 - 1. Type and Form: Type XX, other types; high-density, ceramic- and mineral-base panels with scrubbable finish, resistant to heat, moisture, and corrosive fumes.
 - 2. Pattern: G (smooth).
- C. Color: White.
- D. LR: Not less than 0.88.
- E. CAC: Not less than 40.
- F. Thickness: 5/8 inch.
- G. Modular Size: 24 by 48 inches.
- H. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.6 METAL SUSPENSION SYSTEM

- A. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C635/C635M and designated by type, structural classification, and finish indicated.

- B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation; with prefinished 15/16-inch-wide metal caps on flanges.
 - 1. Structural Classification: Heavy-duty system.
 - 2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
 - 3. Face Design: Flat, flush.
 - 4. Cap Material: Cold-rolled steel or aluminum.
 - 5. Cap Finish: Painted to match color of acoustical unit, unless otherwise selected by the Architect.

2.7 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.
- B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
- C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - 2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.

2.8 METAL SUSPENSION SYSTEM - ACT1, ACT2

- A. Basis-of-Design Product: Subject to compliance with requirements, provide **Armstrong World Industries, Inc.; Prelude XL** or comparable product by one of the following:
 - 1. CertainTeed Corp.
 - 2. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. Wide-Face, Capped, Double-Web, Hot-Dip Galvanized, G60-(Z180), Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; hot-dip galvanized according to ASTM A 653/A 653M, G60 (Z180) coating designation; with prefinished, cold-rolled, 15/16-inch- (24-mm-) wide aluminum caps on flanges.
 - 1. Structural Classification: Heavy-duty system.
 - 2. Face Design: Flat, flush.
 - 3. Face Finish: Painted white.

2.9 METAL EDGE MOLDINGS AND TRIM

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Armstrong World Industries, Inc.
 - 2. CertainTeed Corp.

3. USG Interiors, Inc.; Subsidiary of USG Corporation.

- B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements and fire-resistance-rated requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
1. Provide manufacturer's standard prefinished edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
 2. For circular penetrations of ceiling, provide prefinished edge moldings fabricated to diameter required to fit penetration exactly.
 - 3.

2.10 ACOUSTICAL SEALANT

- A. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.
- B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

- A. Install acoustical panel ceilings according to ASTM C636/C636M and manufacturer's written instructions.
- B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 8. Do not attach hangers to steel deck tabs.
 9. Do not attach hangers to steel roof deck unless permitted by the Structural Engineer and authorities having jurisdiction. Attach hangers to structural members unless otherwise required for structural performance.
 10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
 11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.
1. Arrange directionally patterned acoustical panels as follows:
 - a. As indicated on reflected ceiling plans.

2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
3. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
4. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.4 ERECTION TOLERANCES

- A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.
- B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.
- B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Thermoplastic-rubber base.
 - 2. Rubber molding accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.
- C. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Coordinate mockups in this Section with mockups specified in other Sections.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.7 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOPLASTIC-RUBBER BASE

- A. Basis-of-Design: Subject to compliance with requirements, provide product indicated on the Finish Schedule, or a comparable product as approved by the Architect:
 - 1. Colors and Styles: As indicated on the Finish Schedule.
- B. Product Standard: ASTM F1861, Type TP (rubber, thermoplastic).
 - 1. Group: I (solid, homogeneous).
- C. Thickness: 0.125 inch.
- D. Height: 4 inches, unless otherwise indicated.
- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Preformed.
- G. Inside Corners: Preformed.

2.2 VINYL MOLDING ACCESSORY

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Burke Mercer Flooring Products, Division of Burke Industries Inc.
 - 2. Flexco.
 - 3. Johnsonite; A Tarkett Company.
 - 4. Roppe Corporation, USA.
- B. Description: Vinyl transition strips.
- C. Profile and Dimensions: 5/8" wide transition from resilient flooring to ceramic tile (Basis-of-Design Johnsonite SLT-XX-A), 1 1/2" wide transition from ceramic tile flooring to epoxy (Basis-of-Design Johnsonite CD-XX), and 4" wide transition from ceramic tile to epoxy (Basis-of-Design Johnsonite CE-XX-A).
- D. Locations: Provide vinyl molding accessories to transition from resilient flooring to carpet, resilient flooring to sealed concrete and carpet to sealed concrete.
- E. Colors and Patterns: Must match rubber base color selection. As selected by Architect from full range of industry colors.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
- C. Metal Edge Strips: Extruded aluminum with mill finish, nominal 2 inches wide, of height required to protect exposed edges of flooring, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until materials are the same temperature as space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned. In no event shall pieced runs be less than 2 feet in length.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.
- H. Job-Formed Corners:
 - 1. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Miter or cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.

- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - 2. Sweep and vacuum horizontal surfaces thoroughly.
 - 3. Damp-mop horizontal surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

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SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Solid vinyl plank floor tile.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of resilient floor tile.
 - 1. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - 2. Show details of special patterns.
- C. Samples: Full-size units of each color, texture, and pattern of floor tile required.
- D. Welded-Seam Samples: For seamless-installation technique indicated and for each floor covering product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to a rigid backing and prepared by Installer for this Project.
- E. Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
 - 1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Coordinate mockups in this Section with mockups specified in other Sections.
 - a. Size: Minimum 100 sq. ft. for each type, color, and pattern in locations directed by Architect.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.9 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during floor tile installation.

- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 SOLID VINYL PLANK FLOOR TILE

- A. Luxury Vinyl Plank Tile:
 - 1. Basis-of-Design: Subject to compliance with requirements, provide product indicated on the Finish Schedule, or a comparable product as approved by the Architect:
 - a. Style: As indicated on the Finish Schedule.
 - b. Color: As indicated on the Finish Schedule.
 - c. Size: As indicated on the Finish Schedule.
 - d. Finish: As selected by the Architect from the manufacturer's full range.
- B. Tile Standard: ASTM F1700.
 - 1. Class: Class III, Printed Film Vinyl Tile.
 - 2. Type: B, Embossed Surface.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
- C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 - 4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles in pattern indicated.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 - 1. Lay tiles with grain running in one direction, unless otherwise indicated.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion joint covers and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers to cover perimeters.
- H. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.

1. Apply two coat(s).
- E. Cover floor tile until Substantial Completion.

END OF SECTION 096519

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems, including primers, finish coatings, floor sealers, and dry fall coatings for the following interior substrates:

1. Concrete.
2. Cement board.
3. Concrete masonry units (CMUs).
4. Steel and iron.
5. Galvanized metal.
6. Aluminum (not anodized or otherwise coated).
7. Stainless steel.
8. Wood.
9. Fiberglass.
10. Plastic.
11. Gypsum board.
12. Cotton or canvas insulation covering.
13. ASJ insulation covering.
14. Bituminous-coated surfaces.

- B. Related Requirements:

1. Section 099300 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on interior wood substrates.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include preparation requirements and application instructions.
2. Indicate VOC content.

- B. Samples: For each type of topcoat product.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on samples in steps show each coat required for system.
3. Label each coat of each sample.
4. Label each Sample for location and application area.

- C. Product Schedule: Use same designations indicated on Drawings and in the Interior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint Products: 5 percent, but not less than 1 gal. of each material and color applied.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design: Subject to compliance with requirements, provide products indicated on the Finish Schedule, or comparable products by one of the following as approved by the Architect:
 - 1. Benjamin Moore & Co.
 - 2. PPG Architectural Coatings.
 - 3. Sherwin-Williams Company (The).
- B. Source Limitations: Obtain each paint product from single source from single manufacturer.

2.2 PAINT PRODUCTS, GENERAL

- A. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- B. VOC Content: For field applications that are inside the weatherproofing system, verify paints and coatings comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
1. Flat Paints and Coatings: 50 g/L.
 2. Nonflat Paints and Coatings: 50 g/L.
 3. Dry-Fog Coatings: 150 g/L.
 4. Primers, Sealers, and Undercoaters: 100 g/L.
 5. Shellacs, Pigmented: 550 g/L.
 6. Shellacs, Clear: 730 g/L.
 7. Pretreatment Wash Primers: 420 g/L.
 8. Zinc-Rich Industrial Maintenance Primers: 100 g/L.
 9. Rust-Preventive Coatings: 100 g/L.
- 2.3 Low-Emitting Materials: For field applications that are inside the weatherproofing system, verify 90 percent of paints and coatings comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- A. Colors: As indicated on the Finish Schedule.
- 2.4 PRIMERS
- A. Interior/Exterior Latex Block Filler: Water-based, high-solids, emulsion coating formulated to bridge and fill porous surfaces of exterior concrete masonry units in preparation for specified subsequent coatings.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Sherwin-Williams Company (The); X-Green Pro Industrial Heavy Duty Block Filler or comparable product by one of the following:
 - a. Benjamin Moore & Co.
 - b. PPG Paints.
- B. Interior, Institutional Low-Odor/VOC Primer Sealer: Water-based primer sealer with low-odor characteristics and a VOC of less than 10 grams per liter for use on new interior plaster, concrete, and gypsum wallboard surfaces that are subsequently to be painted with latex finish coats.
1. Basis-of-Design Product: Subject to compliance with requirements, provide PPG Paints; PERMA-CRETE PLEX SEAL WB INTERIOR/EXTERIOR CLEAR SEALER 4-6200XI or comparable product by one of the following:
 - a. Benjamin Moore & Co.
 - b. Sherwin Williams Company (The)
- 2.5 WATER-BASED FINISH COATS
- A. Interior, Latex, Institutional Low Odor/VOC, Flat: White or colored latex paint with low-odor characteristics and a VOC of less than 10 grams per liter, for use in areas, such as hospitals and

other occupied buildings, where the odor and VOC levels of conventional latex products would preclude their use.

1. Basis-of-Design Product: Subject to compliance with requirements, provide [Sherwin-Williams Company \(The\)](#); Emerald or comparable product by one of the following:
 - a. Benjamin Moore & Co.
 - b. PPG Paints.
 2. Gloss and Sheen Level: Maximum gloss of 5 units at 60 degrees and maximum sheen of 10 units at 85 degrees when tested in accordance with ASTM D523 .
- B. Interior, Latex, Institutional Low Odor/VOC, Eggshell: White or colored latex paint with low-odor characteristics and a VOC of less than 10 grams per liter, for use in areas, such as hospitals and other occupied buildings, where the odor and VOC levels of conventional latex products would preclude their use.
1. Basis-of-Design Product: Subject to compliance with requirements, provide [Sherwin-Williams Company \(The\)](#); ProMar 200 HP Zero VOC or comparable product by one of the following:
 - a. Benjamin Moore & Co.
 - b. PPG Paints.
 2. Gloss and Sheen Level: Gloss of 10 to 25 units at 60 degrees and sheen of 10 to 35 units at 85 degrees when tested in accordance with ASTM D523 .
- C. Interior, Water-Based Light-Industrial Coating, Semigloss: Pigmented, water-based emulsion coating for interior primed wood and metal surfaces (e.g., walls, doors, frames, trim, and sash), providing resistance to moderate abrasion and mild chemical exposure and corrosive conditions.
1. Basis-of-Design Product: Subject to compliance with requirements, provide [Sherwin-Williams Company \(The\)](#); Pro Industrial Acrylic Semi-Gloss Coating or comparable product by one of the following:
 - a. Benjamin Moore & Co.
 - b. PPG Paints.
 2. Gloss Level: Gloss of 35 to 70 units at 60 degrees when tested in accordance with ASTM D523 .

2.6 FLOOR SEALERS AND PAINTS

- A. Interior Concrete Stain: Penetrating semitransparent stain specifically manufactured for interior and exterior concrete horizontal and vertical surfaces.
1. Basis-of-Design Product: Subject to compliance with requirements, provide [H&C® Decorative Concrete Products: a brand of Sherwin-Williams Co.](#); Clarishield Wet Look Concrete Sealer or comparable product by one of the following:
 - a. Benjamin Moore & Co.
 - b. PPG Paints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Fiber-Cement Board: 12 percent.
 - 3. Masonry (Clay and CMUs): 12 percent.
 - 4. Wood: 15 percent.
 - 5. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Aluminum Substrates: Remove loose surface oxidation.
- J. Wood Substrates:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- K. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 INSTALLATION

- A. Apply paints according to manufacturer's written instructions.
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire-Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed in equipment rooms:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.

- c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.
 - h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
2. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Architect.
3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

- A. Dry-Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry-film thickness.
 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 2. If test results show that dry-film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry-film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
 1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
 2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
 3. Allow empty paint cans to dry before disposal.
 4. Collect waste paint by type and deliver to recycling or collection facility.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Traffic Surfaces:
 - 1. Water-Based Concrete Floor Sealer System MPI #99 :
 - a. First Coat: Matching topcoat.
 - b. Topcoat: Water-based concrete floor sealer.
- B. CMU Substrates:
 - 1. Institutional Low-Odor/VOC Latex System :
 - a. Block Filler: Interior/exterior latex block filler.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: Interior, latex, institutional low odor/VOC, semigloss.
- C. Steel Substrates:
 - 1. Institutional Low-Odor/VOC Latex System :
 - 2. Prime Coat: Water-based rust-inhibitive primer.
 - a. Intermediate Coat: Matching topcoat.
 - b. Topcoat: Interior, latex, institutional low odor/VOC, semigloss .
- D. Gypsum Board Substrates:
 - 1. Institutional Low-Odor/VOC Latex System :
 - a. Prime Coat: Interior, institutional low-odor/VOC primer sealer.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: Interior, latex, institutional low odor/VOC, eggshell .
 - 1) At Ceilings: Interior, latex, institutional low odor/VOC, flat.
 - 2) At Walls: Interior, latex, institutional low odor/VOC, eggshell.

END OF SECTION 099123

SECTION 099600 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Division 01 Section "Sustainability Requirements" for low-emitting materials used within the Building Interior.
- C. Division 05 Section "Metal Fabrications" for galvanizing repair paint.
- D. Division 09 Section "Interior Painting" for interior painting.

1.2 SUMMARY

- A. Section includes surface preparation and the application of high-performance coating systems on the following substrates:
 - 1. Exterior Substrates:
 - a. Concrete, vertical surfaces.
 - b. Steel.
 - 2. Interior Substrates:
 - a. Concrete Masonry Units
- B. Related Requirements:
 - 1. Section 055213 "Pipe and Tube Railings" for shop priming painting pipe and tube railings with coatings specified in this Section.
 - 2. Section 099123 "Interior Painting" for general field painting.

1.3 DEFINITIONS

- A. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- B. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- C. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
2. Indicate VOC content.

B. Sustainable Design Submittals:

1. Product Data: For paints and coatings, indicating VOC content.
2. Laboratory Test Reports: For paints and coatings, indicating compliance with requirements for low-emitting materials.
3. Manufacturer Inventory: For each product, provide manufacturer's manifest of ingredients.
4. Health Product Declaration: For each product.
5. Environmental Product Declaration: For each product.

C. Samples for Initial Selection: For each type of topcoat product indicated.

D. Samples for Verification: For each type of coating system and each color and gloss of topcoat indicated.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

E. Product List: Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Coatings: percent, but not less than 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

A. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each coating system.
 - a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft..
 - b. Other Items: Architect will designate items or areas required.
2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than **45 deg F**.
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between **50 and 95 deg F**.
- B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than **5 deg F** above the dew point; or to damp or wet surfaces.
- C. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Benjamin Moore & Co.
 2. PPG Paints.
 3. Sherwin-Williams Company (The).

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

3. Products shall be of same manufacturer for each coat in a coating system.
- C. VOC Content: For field applications that are inside the weatherproofing system, verify paints and coatings comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
 1. Flat Paints and Coatings: 50 g/L.
 2. Nonflat Paints and Coatings: 50 g/L.
 3. Primers, Sealers, and Undercoaters: 100 g/L.
 4. Rust-Preventive Coatings: 100 g/L.
 5. Shellacs, Pigmented: 550 g/L.
 6. Shellacs, Clear: 730 g/L.
 7. Floor Coatings: 50 g/L.
 8. Pretreatment Wash Primers: 420 g/L.
 9. Zinc-Rich Industrial Maintenance Primers: 100 g/L.
- D. Low-Emitting Materials: For field applications that are inside the weatherproofing system, verify 90 percent of paints and coatings comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- E. Colors: As selected by Architect from manufacturer's full range .

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 1. Concrete: 12 percent.
 2. Fiber-Cement Board: 12 percent.
 3. Masonry (Clay and CMUs): 12 percent.
 4. Wood: 15 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.

- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
 - 1. Clean surfaces with pressurized water. Use pressure range of 1500 to 4000 psi at 6 to 12 inches.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or alkalinity of mortar joints exceeds that permitted in manufacturer's written instructions.
 - 1. Clean surfaces with pressurized water. Use pressure range of 100 to 600 psi at 6 to 12 inches.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer [.] but not less than the following:
 - 1. SSPC-SP 7/NACE No. 4.
 - 2. SSPC-SP 11.
 - 3. SSPC-SP 6/NACE No. 3.
 - 4. SSPC-SP 10/NACE No. 2.
 - 5. SSPC-SP 5/NACE No. 1.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

3.3 APPLICATION

- A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
 - 1. Use applicators and techniques suited for coating and substrate indicated.

2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
 3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
- D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.5 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Concrete Substrates, Vertical Surfaces:

1. Epoxy System MPI EXT 3.1D:
 - a. Prime Coat: Epoxy, matching topcoat.
 - b. Intermediate Coat: Epoxy, matching topcoat.
 - c. Topcoat: Epoxy, gloss , MPI #77.

B. Steel Substrates:

1. Pigmented Polyurethane over Epoxy Zinc-Rich Primer System MPI EXT 5.1P:
 - a. Prime Coat: Primer, zinc rich, epoxy , MPI #20.
 - b. Intermediate Coat: Epoxy, gloss , MPI #77.
 - c. Topcoat: Polyurethane, two component, pigmented, gloss (MPI Gloss Level 6) , MPI #72.

END OF SECTION 099600

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SECTION 101416 - PLAQUES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes metal plaques.

1.3 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For plaques.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show plaque mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
 - 3. Show message list, typestyles, graphic elements , including raised characters and Braille, and layout for each plaque at least half size .
- C. Samples for Initial Selection: For each type of plaque, exposed component, and exposed finish.
 - 1. Include representative Samples of available typestyles and graphic symbols.
- D. Samples for Verification: For each type of plaque showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
 - 1. Full-size Samples, if approved, will be returned to Contractor for use in the Project.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For plaques to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the ABA standards of the Federal agency having jurisdiction and ICC A117.1 .

2.2 PLAQUES

- A. Cast Plaque : Cast-metal plaque with background texture, border, and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
 - 1. Plaque Material: Cast aluminum .
 - 2. Plaque Thickness: 0.625 inch .
 - 3. Finishes:
 - a. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color as selected by Architect from manufacturer's full range .
 - 4. Background Texture: Pebble .
 - 5. Mounting: Concealed studs .
 - 6. Text and Typeface: . Finish raised characters to contrast with background color, and finish Braille to match background color.

2.3 MATERIALS

- A. Cast Aluminum: ASTM B 26/B 26M, alloy and temper recommended by plaque manufacturer for casting process used and for type of use and finish indicated.

2.4 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of plaques, noncorrosive and compatible with each material joined, and complying with the following:
 - 1. Use concealed fasteners and anchors unless indicated to be exposed.
 - 2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
 - 3. Plaque Mounting Fasteners:

- a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of plaque, screwed into back of plaque, or screwed into tapped lugs cast integrally into back of plaque unless otherwise indicated.
- b. Through Fasteners: Exposed metal fasteners matching plaque finish, with type of head indicated, installed in predrilled holes.

2.5 FABRICATION

- A. General: Provide manufacturer's standard plaques according to requirements indicated.
 1. Preassemble plaques in the shop to greatest extent possible. Disassemble plaques only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
 2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
 3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
 4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 5. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match plaque finish.
 6. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.
- B. Surface-Engraved Graphics: Machine-engrave characters and other graphic devices into indicated plaque surface to produce precisely formed copy, incised to uniform depth.
 1. Engraved Metal: Fill engraved graphics with manufacturer's standard baked enamel.

2.6 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
- D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.7 ALUMINUM FINISHES

- A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of **1.5 mils**. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Verify that plaque-support surfaces are within tolerances to accommodate plaques without gaps or irregularities between backs of plaques and support surfaces unless otherwise indicated.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install plaques using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install plaques level, plumb, true to line, and at locations and heights indicated, with plaque surfaces free of distortion and other defects in appearance.
 - 2. Install plaques so they do not protrude or obstruct according to the accessibility standard.
 - 3. Before installation, verify that plaque surfaces are clean and free of materials or debris that would impair installation.
 - 4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Mounting Methods:
 - 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of plaque. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place plaque in position and push until flush to surface, embedding studs in holes. Temporarily support plaque in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place plaque in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed plaques and plaques that do not comply with specified requirements. Replace plaques with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

- B. Remove temporary protective coverings and strippable films as plaques are installed.
- C. On completion of installation, clean exposed surfaces of plaques according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain plaques in a clean condition during construction and protect from damage until acceptance by Owner.

3.4 SAMPLE CAST ALUMINUM DEDICATION PLAQUE DIAGRAM

- A. Wording for plaque will be provided by Architect upon review of preliminary shop drawing. A sample is shown below.

END OF SECTION 101416

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SECTION 101423.16 - ROOM-IDENTIFICATION PANEL SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes interior and exterior room-identification signs.

1.3 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.

1.4 COORDINATION

- A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For room-identification signs.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
 - 3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
- C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
 - 1. Include representative Samples of available typestyles and graphic symbols.
- D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
 - 1. Room-Identification Signs: Full-size Sample.
 - 2. Full-size Samples, if approved, will be returned to Contractor for use in Project.

- E. Product Schedule: For room-identification signs. Use same designations indicated on Drawings or specified.

1.6 SIGN SCHEDULE

- A. Provide a draft and final signage schedule as indicated below. The schedule shall be produced and submitted per the requirements of submittals. The schedule shall include the information listed in the sample below at a minimum. Final verbiage of all signage subject to review and approval of the architect prior to orderings.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranty: For special warranty.

1.8 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For signs to include in maintenance manuals.

1.9 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Variable Component Materials: 12 replaceable text inserts and interchangeable characters (letters, numbers, and graphic elements) of each type.
 - 2. Tools: One set(s) of specialty tools for assembling signs and replacing variable sign components.

1.10 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer of products.

1.11 FIELD CONDITIONS

- 1. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication and indicate measurements on Shop Drawings.

1.12 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:

- a. Deterioration of finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image.
 - c. Separation or delamination of sheet materials and components.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the United States Access Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

2.2 ROOM-IDENTIFICATION SIGNS

- A. Room-Identification Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
 1. Basis-of-Design: As selected by the Architect.
 2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. AOA Signs.
 - b. APCO Graphics, Inc.
 - c. ASI Sign Systems, Inc.
 - d. Best Sign Systems, Inc.
 - e. Inpro Corporation.
 - f. Mohawk Sign Systems.
 3. Laminated-Sheet Sign: Photopolymer or sandblasted polymer face sheet with raised graphics laminated to acrylic or phenolic backing sheet to produce composite sheet.
 - a. Composite-Sheet Thickness: 0.125 inch
 - b. Surface-Applied Graphics: Applied polymer characters and braille
 - c. Color(s): As selected by Architect from manufacturer's full range.
 4. Sign-Panel Perimeter: Finish edges smooth.
 - a. Edge Condition: Square cut, unless otherwise selected by the Architect.
 - b. Corner Condition in Elevation: Square, unless otherwise selected by the Architect.
 5. Mounting: Manufacturer's standard method for substrates indicated with.
 6. Text and Typeface: . Finish raised characters to contrast with background color, and finish Braille to match background color.
 - a. Font shall be Helvetica Medium, Upper case only.
 - b. All letters and numbers to be one inch high minimum unless otherwise noted. Height to be measured at an upper case letter 'X'
 - c. Letters and numbers shall have a width to height ratio between 3:5 and 1:1 and a stroke width to height between 1:5 and 1:10.

7. Tactile and Braille Copy: Manufacturer's standard process for producing copy complying with ADA Accessibility Guidelines and ICC/ANSI A117.1 and the North Carolina Accessibility Code.
 - a. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square cut edges free from burrs and cut marks.
 - 1) Dot height standard minimum .025 inch.
 - 2) Dot maximum 1/32 inch.
 - 3) Inter-dot spacing to be 0.090 inch.
 - 4) All dots to be perfectly rounded (domed).
 - 5) All dots to be embedded rasters 0.0625 inch diameter.

2.3 SIGN MATERIALS

- A. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).
- B. Vinyl Film: UV-resistant vinyl film with pressure-sensitive, permanent adhesive; die cut to form characters or images as indicated on Drawings and suitable for exterior applications for exterior signs.
- C. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.4 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
 1. Use concealed fasteners and anchors unless indicated to be exposed.
 2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
 3. Exposed Metal-Fastener Components, General:
 - a. Fabricated from same basic metal and finish of fastened sign unless otherwise indicated.
 4. Sign Mounting Fasteners:
 - a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly unless otherwise indicated.
 - b. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, and installed in predrilled holes.

2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly

- mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
 - 2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
 - 3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 - 4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
- B. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.
- C. Subsurface-Etched Graphics: Reverse etch back face of clear face-sheet material. Fill resulting copy with manufacturer's standard enamel. Apply opaque manufacturer's standard background color coating over enamel-filled copy.

2.6 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
- 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Install signs so they do not protrude or obstruct according to the accessibility standard.
 - 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
- B. Accessibility: Install signs in locations on walls as indicated on Drawings and according to the accessibility standard.
- C. Mounting Methods:
- 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface,

- embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
- b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
2. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
 3. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
 4. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.
 5. Hook-and-Loop Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply sign component of two-part tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage; push to engage tape adhesive. Keep tape strips 0.250 inch away from edges to prevent visibility at sign edges when sign is initially installed or reinstalled. Apply substrate component of tape to substrate in locations aligning with tape on back of sign; push and rub well to fully engage tape adhesive to substrate.
 6. Magnetic Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position.

3.2 INTERIOR SIGNAGE TYPES

- A. All interior spaces shall receive a sign adjacent to each interior door entering that space. Exact numbering to be coordinated with the Architect and owner prior to finalizing the numbering and naming system.
- B. Toilet room entries shall have the international accessibility logo integral with the sign body. See signage types in the Drawings.
- C. Provide signs for the following locations. Prepare a draft signage schedule based on the following:
 1. As indicated on sheet A700.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101423.16

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SECTION 102600 - WALL PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Corner guards.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.
 - 2. Include fire ratings of units recessed in fire-rated walls.
- B. Shop Drawings: For each type of wall protection showing locations and extent.
 - 1. Include plans, elevations, sections, and attachment details.
- C. Samples for Initial Selection: For each type of impact-resistant wall-protection unit indicated, in each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of handrail.
- B. Material Certificates: For each type of exposed plastic material.
- C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of wall protection product to include in maintenance manuals.
 - 1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include

precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Corner-Guard Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of cover installed, but no fewer than two, 48-inch- long units.
 - 2. Mounting and Accessory Components: Amounts proportional to the quantities of extra materials. Package mounting and accessory components with each extra material.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store wall protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
 - 1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
 - 2. Keep plastic materials out of direct sunlight.
 - 3. Store plastic wall-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.
 - a. Store corner-guard covers in a vertical position.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of wall-protection units that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
 - b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain wall-protection products from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Surface Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ANSI/ICC A117.1.

2.3 CORNER GUARDS

- A. Flush-Mounted, Plastic-Cover Corner Guards: Manufacturer's standard assembly consisting of snap-on, resilient plastic cover that is flush with adjacent wall surface, installed over retainer; including mounting hardware; fabricated with 90-degree turn to match wall condition; full wall height.
 - 1. Basis-of-Design: Subject to compliance with requirements, provide product by Construction Specialties, Inc. as indicated on the Finish Schedule, or a comparable product as approved by the Architect.
 - 2. Cover: Extruded rigid plastic, minimum 0.078-inch wall thickness; as follows:
 - a. Profile: Nominal 3- inch long leg and ¼" corner radius
 - b. Height: 6 feet, unless otherwise indicated.
 - c. Color and Texture: As selected by the Architect from the manufacturer's full range.
 - 3. Continuous Retainer: Minimum 0.060-inch-thick, one-piece, extruded aluminum.
 - 4. Retainer Clips: Manufacturer's standard impact-absorbing clips.
 - 5. Top and Bottom Caps: Prefabricated, injection-molded plastic, color-matching cover, field adjustable for close alignment with snap on cover.

2.4 MATERIALS

- A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.
- B. Polycarbonate Plastic Sheet: ASTM D6098, S-PC01, Class 1 or Class 2, abrasion resistant; with a minimum impact-resistance rating of 15 ft.-lbf/in. of notch when tested according to ASTM D256, Test Method A.
- C. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.
- D. Adhesive: As recommended by protection product manufacturer.

2.5 FABRICATION

- A. Fabricate wall protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.
- B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
- C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.6 FINISHES

- A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances, fire rating, and other conditions affecting performance of the Work.
- B. Examine walls to which wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
 - 1. For wall protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing wall protection.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

- A. Installation Quality: Install wall protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
- B. Mounting Heights: Install wall protection in locations and at mounting heights indicated on Drawings.
- C. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.
 - 1. Provide anchoring devices and suitable locations to withstand imposed loads.
 - 2. Where splices occur in horizontal runs of more than 20 feet, splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches apart.
 - 3. Adjust caps as required to ensure tight seams.

3.4 CLEANING

- A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.
- B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600

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SECTION 102800 – TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Public-use washroom accessories.
 - 2. Public-use shower room accessories.
 - 3. Automated external defibrillator and cabinet.
 - 4. Custodial accessories.
- B. Related Requirements:
 - 1. Section 088300 "Mirrors" for frameless mirrors in fitness areas.

1.3 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Include electrical characteristics.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify accessories using designations indicated.

C. Delegated Design Submittal: For grab bars.

1. Include structural design calculations indicating compliance with specified structural-performance requirements.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.7 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, visible silver spoilage defects.
2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Structural Performance: Design accessories and fasteners to comply with the following requirements:
 1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

- A. Source Limitations: Obtain each type of public-use washroom accessory from single source from single manufacturer.
- B. Paper Towel Dispenser - **FF&E Item 01**
 1. Basis-of-Design Product: Subject to compliance with requirements, provide [Bobrick Washroom Equipment, Inc.](#) B-262 or comparable product by one of the following:
 - a. American Specialties, Inc.
 - b. Bradley Corporation.
- C. Toilet Paper Dispenser – **FF&E Item 03**

1. Basis-of-Design Product: Subject to compliance with requirements, provide [Bobrick Washroom Equipment, Inc](#); B-2888 or comparable product by one of the following:
 - a. American Specialties, Inc.
 - b. Bradley Corporation.
- D. Soap Dispenser – **FF&E Item 05**
 1. Basis-of-Design Product: Subject to compliance with requirements, provide [Bobrick Washroom Equipment, Inc](#); B-2112 or comparable product by one of the following:
 - a. American Specialties, Inc.
 - b. Bradley Corporation.
- E. Grab Bar – **FF&E Items 10,11,12,13**
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Specialties, Inc.
 - b. Bobrick Washroom Equipment, Inc.
 - c. Bradley Corporation.
 2. Mounting: Flanges with concealed fasteners.
 3. Material: Stainless steel, 0.05 inch thick.
 - a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin) on ends and slip-resistant texture in grip area.
 4. Outside Diameter: 1-1/2 inches .
 5. Configuration and Length: As indicated on Drawings .
- F. Sanitary-Napkin Disposal Unit: **FF&E Item 02**
 1. Basis-of-Design Product: As selected by the Architect.
 2. Door or Cover: Self-closing, disposal-opening cover.
 3. Receptacle: Removable.
 4. Material and Finish: As selected by the Architect.
- G. Mirror Unit – **FF&E Item 09**
 1. Basis-of-Design Product: Subject to compliance with requirements, provide [Bobrick Washroom Equipment, Inc](#); B-165 or comparable product by one of the following:
 - a. American Specialties, Inc.
 - b. Bradley Corporation.
 2. Frame: Stainless steel channel .
 - a. Corners: Mitered and mechanically interlocked .
 3. Size: As indicated on Drawings .
 4. Hangers: Manufacturer's standard rigid, tamper and theft resistant .

2.3 PUBLIC-USE SHOWER ROOM ACCESSORIES

- A. Source Limitations: Obtain public-use shower room accessories from single source from single manufacturer.
- B. Shower Curtain Rod – **FF&E Item 07**
 1. Basis-of-Design Product: Subject to compliance with requirements, provide [Bobrick Washroom Equipment, Inc](#); B-6047 or comparable product by one of the following:
 - a. American Specialties, Inc.

2. Description: 1-1/4-inch- outside diameter, straight rod.
3. Configuration: As indicated on Drawings
4. Mounting Flanges: Exposed fasteners; in material and finish matching rod .
5. Rod Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin) .
6. Shower Curtain Hooks: Chrome-plated or stainless steel, spring wire curtain hooks with snap fasteners , sized to accommodate specified curtain rod. Provide one hook per curtain grommet.

C. Folding ADA Shower Seat – **FF&E Item 06:**

1. Basis-of-Design Product: As selected by the Architect.
2. Configuration: L-shaped seat, designed for wheelchair access.
3. Seat: Phenolic or polymeric composite of slat-type or one-piece construction in color as selected by Architect.
4. Mounting Mechanism: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

D. Recessed Stainless Steel Shelf – **FF&E Item 15**

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bradley Recessed Shelf 760 or comparable product by one of the following:
 - a. American Specialties, Inc.
 - b. ALFI Brand.
2. Description:
 - a. Flange: 22 gauge stainless steel with exposed surfaces in architectural satin finish. One-piece seamless construction, 3/4" wide with burr-free bevel edge.
 - b. Cabinet: 22 gauge stainless steel. All welded construction. Not leakproof
3. Material: 22 gauge stainless steel with exposed surfaces in satin finish.

E. Towel Hook – **FF&E Item 08**

1. Basis-of-Design Product: Subject to compliance with requirements, provide [Bobrick Washroom Equipment, Inc.](#) B-6727 or comparable product by one of the following:
 - a. American Specialties, Inc.
 - b. Bradley Corporation.
2. Description: Double -prong unit.
3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin) .

2.4 CUSTODIAL ACCESSORIES

- A. Source Limitations: Obtain each type of custodial accessory from single source from single manufacturer.

B. Custodial Mop and Broom Holder – **FF&E Item 20**

1. Basis-of-Design Product: As selected by the Architect.
2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
3. Length: 36 inches.
4. Hooks: Three or four.
5. Mop/Broom Holders: Three or four, spring-loaded, rubber hat, cam type.
6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
 - a. Shelf: Not less than nominal 0.05-inch-thick stainless steel.

- b. Rod: Approximately 1/4-inch-diameter stainless steel.

2.5 UNDERLAVATORY GUARDS

A. Underlavatory Guard: **FF&E Item 04**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Buckaroos, Inc.
 - b. Plumberex Specialty Products, Inc.
 - c. Truebro by IPS Corporation.
2. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
3. Material and Finish: Antimicrobial, molded plastic, white.

2.6 MATERIALS

- A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch-minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B19, flat products; ASTM B16/B16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B30, castings.
- C. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel), 0.036-inch-minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A653/A653M, with G60 hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer or specified in this Section, and tamper and theft resistant where exposed, and of stainless or galvanized steel where concealed.
- G. Chrome Plating: ASTM B456, Service Condition Number SC 2 (moderate service).
- H. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.7 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
 - 1. Remove temporary labels and protective coatings.
- B. Grab Bars: Install to comply with specified structural-performance requirements.
 - 1. Provide continuous, concealed blocking. Install to withstand a downward load of at least 250 lbf (112 N), when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION 102800

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Fire-protection cabinets for the following:
 - a. Portable fire extinguisher.

- B. Related Requirements:

- 1. Section 104416 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- 1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing semirecessed--mounting method and relationships of box and trim to surrounding construction.

- B. Shop Drawings: For fire-protection cabinets.

- 1. Include plans, elevations, sections, details, and attachments to other work.

- C. Samples: For each type of exposed finish required.

- D. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.5 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

2.3 FIRE-PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or a comparable product as approved by the Architect:
 - a. Activar Construction Products Group, Inc. - JL Industries.
 - b. Guardian Fire Equipment, Inc.
 - c. Larsens Manufacturing Company.
 - d. Potter Roemer LLC; a Division of Morris Group International.
 - e. Strike First Corporation of America (The).
- B. Cabinet Construction: Nonrated and fire rated, matching rating of substrate wall.
 - 1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch-thick cold-rolled steel sheet lined with minimum 5/8-inch-thick fire-barrier material. Provide factory-drilled mounting holes.
- C. Cabinet Material: Stainless steel sheet.
 - 1. Shelf: Same metal and finish as cabinet.
- D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
 - 1. Rolled-Edge Trim: 3-inch backbend depth.
 - 2. Cabinet Size: 10 1/2" wide x 24" tall x 6" deep.
- E. Cabinet Trim Material: Same material and finish as door.

- F. Door Material: Stainless steel sheet.
- G. Door Style: Vertical duo panel with frame, unless otherwise selected by the Architect.
- H. Door Glazing: Tempered float glass (clear).
- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide manufacturer's standard pull and latch.
 - 2. Provide continuous hinge, of same material and finish as trim,, permitting door to open 180 degrees.
- J. Accessories:
 - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - 2. Break-Glass Strike: Manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet.
 - 3. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
 - 4. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
 - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet glazing.
 - 2) Application Process: Silk-screened.
 - 3) Lettering Color: White.
 - 4) Orientation: Vertical.
 - 5. Alarm: Manufacturer's standard alarm that actuates when fire-protection cabinet door is opened and that is powered by batteries or low voltage, complete with transformer.
- K. Materials:
 - 1. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304.
 - a. Finish: ASTM A480/A480M No. 4 directional satin finish,.
 - 2. Tempered Float Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).
 - 3. Tempered Break Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 1.5 mm thick.

2.4 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
 2. Miter corners and grind smooth.
 3. Provide factory-drilled mounting holes.
 4. Prepare doors and frames to receive locks.
 5. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 2. Miter and weld perimeter door frames and grind smooth.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated below or at heights acceptable to authorities having jurisdiction.
 - 1. Fire-Protection Cabinet Mounting Height: 42 inches above finished floor to top of fire extinguisher.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
 - 2. Provide inside latch and lock for break-glass panels.
 - 3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

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SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.
- B. Related Requirements:
 - 1. Section 104413 "Fire Protection Cabinets."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.6 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10 when testing interval required by NFPA 10 is within the warranty period.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or a comparable product as approved by the Architect:
 - a. Activar Construction Products Group, Inc. - JL Industries.
 - b. Guardian Fire Equipment, Inc.
 - c. Larsens Manufacturing Company.
 - d. Potter Roemer LLC; a Division of Morris Group International.
 - e. Strike First Corporation of America (The).
 - 2. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.
 - 3. Valves: Nickle-plated, polished-brass body.
 - 4. Handles and Levers: Manufacturer's standard.
 - 5. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

- B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.3 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red or black baked-enamel finish.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or a comparable product as approved by the Architect:
 - a. Activar Construction Products Group, Inc. - JL Industries.
 - b. Guardian Fire Equipment, Inc.
 - c. Larsens Manufacturing Company.
 - d. Potter Roemer LLC; a Division of Morris Group International.
 - e. Strike First Corporation of America (The).
 - 2. Source Limitations: Obtain mounting brackets and fire extinguishers from single source from single manufacturer.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
 - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
 - 1. Mounting Brackets: Top of fire extinguisher to be at 42 inches above finished floor.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 105113 - METAL LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Welded lockers.
 - 2. Welded gear lockers.
- B. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker.
- C. Shop Drawings: For metal lockers.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Show locker trim and accessories.
 - 3. Include locker identification system and numbering sequence.
- D. Samples: For each color specified, in manufacturer's standard size.
- E. Product Schedule: For lockers.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. The following metal locker hardware items equal to 10 percent of amount installed for each type and finish installed, but no fewer than five units:
 - a. Locks.
 - b. Blank identification plates.
 - c. Hooks.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.
- B. Deliver master and control keys or combination control charts to Owner by registered mail or overnight package service.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.8 COORDINATION

- A. Coordinate sizes and locations of wood bases for metal lockers.
- B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures.
 - b. Faulty operation of latches and other door hardware.
 - 2. Damage from deliberate destruction and vandalism is excluded.
 - 3. Warranty Period for Welded Metal Lockers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain metal lockers and accessories from single source from single locker manufacturer.
 - 1. Obtain locks from single lock manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: For lockers indicated to be accessible, comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design," the ABA standards of the Federal agency having jurisdiction, and ICC/ANSI A117.1.

2.3 WELDED LOCKERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AJW Architectural Products.
 - 2. Art Metal Products.
 - 3. ASI Storage Solutions.
 - 4. DEBOURGH ALL-AMERICAN LOCKERS.
 - 5. General Storage Systems Ltd.
 - 6. List Industries Inc.
 - 7. Lyon Workspace Products, LLC.
 - 8. Penco Products, Inc.
 - 9. Republic Storage Systems, LLC.
 - 10. WEC Manufacturing LLC.
- B. Doors: One piece; fabricated from 0.075-inch nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.
 - 1. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches wide; welded to inner face of doors.
 - 2. Door Style: Vented panel as follows:
 - a. Louvered Vents: No fewer than six louver openings at top and bottom for double-tier lockers.
- C. Body: Assembled by welding body components together. Fabricate from unperforated steel sheet with thicknesses as follows:
 - 1. Tops, Bottoms, and Sides: 0.060-inch nominal thickness.
 - 2. Backs: 0.048-inch nominal thickness.
 - 3. Shelves: 0.060-inch nominal thickness, with double bend at front and single bend at sides and back.

- D. Single Tier Locker Arrangement:
 - 1. Size: 12" wide x 12" deep x 14 ¾" tall , wall mounted
- E. Frames: Channel formed; fabricated from 0.060-inch nominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.
 - 1. Cross Frames between Tiers: Channel formed and fabricated from same material as main frames; welded to vertical main frames.
- F. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.
 - 1. Knuckle hinges: Steel, full loop, five or seven knuckles, tight pin; minimum 2 inches high. Provide no fewer than three hinges for each door more than 42 inches high.
- G. Projecting Door Handle and Latch: Finger-lift latch control designed for use with either built-in combination locks or padlocks; positive automatic latching, chromium plated; pry and vandal resistant.
 - 1. Latch Hooks: Equip doors 48 inches and higher with three latch hooks and doors less than 48 inches high with two latch hooks; fabricated from 0.105-inch nominal-thickness steel sheet; welded or riveted to full-height door strikes; with resilient silencer on each latch hook.
 - 2. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.
- H. Recessed Door Handle and Latch: Stainless steel cup with integral door pull, recessed so locking device does not protrude beyond door face; pry and vandal resistant.
 - 1. Single-Point Latching: Nonmoving latch hook designed to engage bolt of built-in combination or cylinder lock or with steel padlock loop that projects through recessed cup and is finished to match metal locker body.
 - a. Latch Hook: Equip each door with one latch hook, fabricated from 0.120-inch nominal-thickness steel sheet; welded midway up full-height door strike; with resilient silencer.
- I. Locks: combination padlocks.
- J. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch high.
- K. Hooks: Manufacturer's standard ball-pointed, aluminum or steel; zinc plated.
- L. Continuous Zee Base: Fabricated from, manufacturer's standard thickness, but not less than 0.060-inch nominal-thickness steel sheet.
 - 1. Height: 4 inches.

- M. Recess Trim: Fabricated from 0.048-inch nominal-thickness steel sheet.
- N. Filler Panels: Fabricated from 0.048-inch nominal-thickness steel sheet.
- O. Boxed End Panels: Fabricated from 0.048-inch nominal-thickness steel sheet.
- P. Finished End Panels: Fabricated from 0.024-inch nominal-thickness steel sheet to cover unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.
- Q. Materials:
 - 1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
- R. Finish: Baked enamel or powder coat.
 - 1. Color: As selected by Architect from manufacturer's full range.

2.4 LOCKS

- A. Combination Padlock: Key-controlled, three-number dialing combination locks; capable of five combination changes.

2.5 FABRICATION

- A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.
 - 1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
 - 2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.
- B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.
- C. Equipment: Provide each locker with an identification plate and the following equipment:
 - 1. Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.
- D. Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections; with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds smooth and flush.
- E. Accessible Lockers: Fabricate as follows:
 - 1. Locate bottom shelf no lower than 15 inches above the floor.

2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches above the floor.
- F. Continuous Zee Base: Fabricated in lengths as long as practical to enclose base and base ends; finished to match lockers.
- G. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.
 1. Sloping top corner fillers, mitered
- H. Recess Trim: Fabricated with minimum 2-1/2-inch face width and in lengths as long as practical; finished to match lockers.
- I. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.
- J. Boxed End Panels: Fabricated with 1-inch-wide edge dimension, and designed for concealing fasteners and holes at exposed ends of nonrecessed metal lockers; finished to match lockers.
 1. Provide one-piece panels for double-row (back-to-back) locker ends.
- K. Finished End Panels: Fabricated to conceal unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.
 1. Provide one-piece panels for double-row (back-to-back) locker ends.
- L. Center Dividers: Full-depth, vertical partitions between bottom and shelf; finished to match lockers.

2.6 ACCESSORIES

- A. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.
- B. Anchors: Material, type, and size required for secure anchorage to each substrate.
 1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls, and elsewhere as indicated, for corrosion resistance.
 2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and floors or support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install lockers level, plumb, and true; shim as required, using concealed shims.
 - 1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
 - 2. Anchor single rows of metal lockers to walls near top and bottom of lockers.
 - 3. Anchor back-to-back metal lockers to floor.
- B. Welded Lockers: Connect groups together with manufacturer's standard fasteners, with no exposed fasteners on face frames.
- C. Equipment:
 - 1. Attach hooks with at least two fasteners.
 - 2. Attach door locks on doors using security-type fasteners.
 - 3. Identification Plates: Identify metal lockers with identification indicated on Drawings.
 - a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
 - b. Attach plates to upper shelf of each open-front metal locker, centered, with a least two aluminum rivets.
- D. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
 - 1. Attach recess trim to recessed metal lockers with concealed clips.
 - 2. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings.
 - 3. Attach finished end panels using fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.

3.3 ADJUSTING

- A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.

3.4 PROTECTION

- A. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.
- B. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 105113

SECTION 105300 – ALUMINUM CANOPIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Extruded aluminum overhead hanger rod style metal entrance canopies.

1.3 PERFORMANCE REQUIREMENTS

- A. Design, fabricate, and install metal entrance canopies to withstand loads from gravity, wind, snow, ponding, drift, and structural movement, including thermally induced movement; and to resist, without failure, other conditions of in-service use, including exposure to weather.
 - 1. Determine wind loads based on uniform pressure indicated on the Drawings, acting upward or downward.
- B. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, tearing of fabric, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.4 SUBMITTALS

- A. Product Data: For each type of metal entrance canopy indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, attachments to other work, and operational clearances. Show colors and graphic layout and content.
 - 1. Include wiring diagrams for integrated lighting fixtures.
 - 2. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Samples: For each colored or finished metal entrance canopy component.
- D. Welding certificates.

- E. Research/Evaluation reports for anchors and fasteners.
- F. Maintenance data.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
 - 1. Installer's responsibilities include fabricating and installing metal entrance canopies and providing professional engineering services needed to assume engineering responsibility.
- B. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code--Aluminum."
- C. Fire-Test-Response Characteristics: Provide metal entrance canopy fabrics with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Flame-Resistance Ratings: Passes NFPA 701.
- D. Mockups: Before installing metal entrance canopies, build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution and set quality standards for fabrication and installation.
 - 1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVER, STORAGE, HANDLING

- A. Deliver and store canopy components in protected areas.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer and fabricator agree to repair or replace components of metal entrance canopies that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including framework.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Metal Entrance Canopy Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide product by one of the following:
 - 1. Dittmer Architectural Aluminum.
 - 2. Mapes Industries, Inc.
 - 3. Superior Metal Products Co., Inc.

2.2 MATERIALS

- A. Aluminum Decking: Extruded aluminum, not less than 2-³/₄ inch flute depth, minimum thickness .078 inch.
- B. Hanger rods and attachment hardware: Powder coated to match canopy.
- C. Fascia: 8 inch extruded aluminum, style as indicated, minimum thickness .125 inch.
- D. Aluminum Decking and Fascia: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated and with not less than the strength and durability properties of alloy and temper required by structural loads.
 - 1. Aluminum Plate and Sheet: ASTM B 209.
 - 2. Aluminum Extrusions: ASTM B 221.
 - 3. Extruded Structural Pipe and Round Tubing: ASTM B 429, standard weight (Schedule 40) unless another weight is indicated or required by structural loads.
 - 4. Drawn Seamless Tubing: ASTM B 210.
 - 5. Aluminum Finish: Clear anodized finish complying with finish manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.
- E. Anchors, Fasteners, Fittings, Hardware, and Installation Accessories: Complying with performance requirements indicated and suitable for exposure conditions, supporting structure, anchoring substrates, and installation methods indicated. Corrosion-resistant or noncorrodible units; weather-resistant, tamperproof, vandal- and theft-resistant, compatible, nonstaining materials. Provide as required for metal entrance canopy assembly, mounting, and secure attachment. Number as needed to comply with performance requirements and to maximize appearance; evenly spaced. Where exposed to view, with finish and color as selected by Architect from manufacturer's full range.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.3 FABRICATION

- A. Mechanically assemble connections, using 3/16 inch fasteners with a minimum shear stress of 350 lb. Do not use pre-welded or factory-welded connections.

- B. Provide decking with interlocking extruded aluminum members, with mechanical fasteners field-applied to provide structural integrity for the completed assembly.
- C. Concealed drainage: Provide system to drain water from covered surfaces into integral fascia gutter and direct to front for front drainage or to rear for ground level discharge via one or more dedicated downspouts.
- D. Frames: Preassemble metal entrance canopy frames in shop to greatest extent possible.
 - 1. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
 - 2. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
 - 3. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Fabricate slip-fit connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
 - 4. Weld corners and connections continuously. Obtain fusion without undercut or overlap. Remove welding flux immediately. At exposed corners and connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
 - 5. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications in place and to properly transfer loads.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install metal entrance canopies at locations and in position indicated, securely connected to supports, free of rack, and in proper relation to adjacent construction. Use mounting methods of types described and in compliance with Shop Drawings and fabricator's written instructions.
- B. Perform installation using an installer approved by the manufacturer.
- C. Install metal entrance canopies after other finishing operations, including joint sealing and painting, have been completed, or protect from damage caused by adjacent work.
- D. Assemble component connections accurately together to form hairline joints and tighten to secure.
- E. Weld frame connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
 - 1. Field Welding: Comply with the following requirements:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove welding flux immediately.

- d. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Anchoring to In-Place Construction: Use anchors, fasteners, fittings, hardware, and installation accessories where necessary for securing metal entrance canopies to structural support and for properly transferring load to in-place construction.
- G. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.
- H. Coordinate metal entrance canopy installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed exterior wall and roof assemblies.
- I. Connections: Connect electrical lighting to building electrical system.
- J. Touchup Painting: Immediately after erection, clean field welds, connections, and abraded areas. Paint uncoated and abraded areas with same or compatible material as used for shop-applied finish painting. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

END OF SECTION 105300

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SECTION 107500 – FLAGPOLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes ground-set flagpoles made from aluminum.
- B. Related Sections include the following:
 - 1. Division 3 Section "Cast-in-Place Concrete" for concrete footings for flagpoles.
 - 2. Division 7 Section "Joint Sealants" for elastomeric sealant filling the top of the foundation tube.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide flagpole assemblies, including anchorages and supports, capable of withstanding the effects of wind loads, determined according to NAAMM FP 1001, "Guide Specifications for Design of Metal Flagpoles", or to specified wind speed, whichever is more stringent.
 - 1. Base flagpole design on polyester flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.
 - 2. Basic Wind Speed: As indicated on the drawings or as required by the governing building code. 3-second gust speed at 33 feet (10 m) aboveground.

1.4 SUBMITTALS

- A. Product Data: For each type of flagpole required.
- B. Shop Drawings: Include elevations and details showing general arrangement, jointing, fittings and accessories, grounding, and anchoring and supporting systems.

1. Include details of foundation system for ground-set flagpoles.
 - C. Structural Calculations: For flagpoles indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - D. Finish Samples for Verification: For each finished material used for flagpoles and accessories.
 - E. Qualification Data: For professional engineer.
- 1.5 QUALITY ASSURANCE
- A. Source Limitations: Obtain each flagpole as a complete unit, including fittings, accessories, bases, and anchorage devices, from a single manufacturer.
 1. Obtain flagpoles through one source from a single manufacturer.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. General: Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. American Flagpole; a Kearney-National Inc. Company.
 2. Baartol Company Inc. (The)
 3. Concord Industries, Inc.
 4. Eder Flag Manufacturing Company, Inc.
 5. Ewing International.
 6. Lingo Inc.; Acme Flagpole Division.
 7. Michigan Flagpole Inc.
 8. Pole-Tech Company Inc.

2.2 FLAGPOLES

- A. Flagpole Construction, General: Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:
 - 1. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.
 - 2. For tapered flagpoles, provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.
- B. Exposed Height: 35'-0"
- C. Aluminum Flagpoles: Provide cone-tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B 241/ (B 241M), Alloy 6063, with a minimum wall thickness of 3/16 inch (4.8 mm). Heat treat after fabrication to comply with ASTM B 597, Temper T6.
- D. Foundation Tube: Galvanized corrugated-steel foundation tube, 0.064-inch- (1.6-mm-) minimum nominal wall thickness. Provide with 3/16-inch (4.8-mm) steel bottom plate and support plate; 3/4-inch- (19-mm-) diameter, steel ground spike; and steel centering wedges all welded together. Galvanize steel parts, including foundation tube, after assembly. Provide loose hardwood wedges at top of foundation tube for plumbing pole.
 - 1. Provide flashing collar of same material and finish as flagpole.

2.3 FITTINGS

- A. Finial Ball: Manufacturer's standard flush-seam ball, sized as indicated or, if not indicated, to match flagpole-butt diameter.
 - 1. 0.063-inch (1.6-mm) spun aluminum, finished to match flagpole.
- B. Internal Revolving Truck Assembly: Cast aluminum heavy-duty revolving truck with sealed stainless steel bearing assemblies, aluminum spindle, cast brass exit bushing and removable hood.
- C. Internal Halyard Winch System: Provide one (1) complete internal halyard 1/8" stainless steel wire cable assembly with plastic coated, dual attachment point counterweight and beaded sling

assembly. A manually operated mechanical winch having automatic brake system and operated with a removable hand crank will be concealed inside the flagpole behind a flush access door having a cylinder lock.

D. Halyard Flag Snaps: Provide two stainless-steel swivel snap hooks per halyard.

1. Provide with neoprene or vinyl covers.

2.4 LIGHTING

A. Provide factory sealed, LED In-Ground flagpole up light that is factory assembled with a 15' power cord pre-installed.

1. Multi-tap 120-277 VAC
2. 25 Watt LED Plate
3. 20 degree beam spread
4. 4300 lumens / 5000 Kelvin
5. CRI: 80
6. Lamp hours with photocell
7. Concrete pour kit
8. One year warranty on fixture and finish
9. 3 year warranty on LED module

B. Construction:

1. Compression molded, fiberglass reinforced composite housing

C. Mounting

1. In-ground fixture shall be installed according to manufacturer's installation instructions.
2. LED Driver, stainless steel ring, directional louver with etched slip-resistant glass
3. Fixture must be installed by a licensed electrician.

2.5 MISCELLANEOUS MATERIALS

A. Concrete: Provide concrete composed of portland cement, coarse and fine aggregate, and water mixed in proportions to attain a 28-day compressive strength of not less than 3000 psi (20 MPa), complying with ASTM C 94/C 94M.

B. Sand: ASTM C 33, fine aggregate.

C. Elastomeric Joint Sealant: Multicomponent urethane, Single-component urethane or Single-component neutral-curing silicone joint sealant complying with requirements in Division 7

Section "Joint Sealants" for Use NT (nontraffic) and for Use M, G, A, and, as applicable to joint substrates indicated, O joint substrates.

2.6 FINISHES

- A. Metal Finishes, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Aluminum: Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 - 1. Anodized Finishes: Provide Class 1 finish complying with AA M32-C22-A41 (Clear Anodized) or AA M32-C22-A42 (Color Anodized Finishes) in thicknesses ranging from 1 to 3 mils.
 - 2. Color to be determined

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.
- B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete.
- C. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms and foundation tube, sleeve, or anchor bolts in position, to prevent displacement during concreting.
- D. Place concrete immediately after mixing. Compact concrete in place by using vibrators. Moist-cure exposed concrete for not less than seven days or use non staining curing compound.
- E. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

3.2 FLAGPOLE INSTALLATION

- A. General: Install flagpoles where shown and according to Shop Drawings and manufacturer's written instructions.
- B. Foundation-Tube Installation: Install flagpole in foundation tube, seated on bottom plate between steel centering wedges. Plumb flagpole and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch (50-mm) layer of elastomeric joint sealant and cover with flashing collar.

END OF SECTION 10350

SECTION 122113 - HORIZONTAL LOUVER BLINDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Horizontal louver blinds with aluminum slats.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For horizontal louver blinds, include fabrication and installation details.
- C. Samples: For each exposed product and for each color and texture specified, 12 inches long.
- D. Product Schedule: For horizontal louver blinds. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For horizontal louver blinds with polymer slats that have been tested for compliance with NFPA 701, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For horizontal louver blinds to include in maintenance manuals.
 - 1. Precautions about cleaning materials and methods that could be detrimental to finishes and performance.
 - 2. Operating hardware.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Horizontal Louver Blinds: Full-size units equal to 5 percent of quantity installed for each size, color, texture, pattern, and gloss indicated, but no fewer than two units.

1.7 QUALITY ASSURANCE

- A. Source Limitations: Obtain horizontal louver blinds through one source from single manufacturer.
- B. Fire-Test-Response Characteristics: Provide horizontal louver blinds with the fire-test-response characteristics as indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 1. Flame Resistance Ratings: Passes NFPA 701.
- C. Product Standard: Provide horizontal louver blinds complying with WCSC A 100.1.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver horizontal louver blinds in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install horizontal louver blinds until construction and wet-work and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where horizontal louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Horizontal Louver Blinds, Aluminum Louver Slats:
 - a. Hunter Douglas.
 - b. Levolor, a Newell Rubbermaid Company.
 - c. Springs Window Fashions Division, Inc.

2.2 HORIZONTAL LOUVER BLINDS, ALUMINUM SLATS

- A. Louver Slats: Aluminum, alloy and temper recommended by producer for type of use and finish indicated; with crowned profile and 1/8 to 3/16 inch radiused corners.
 - 1. Nominal Slat Width: 2 inch
 - a. Slat Spacing: Every .71 inches.
 - 2. Nominal Slat Thickness: Not less than 0.008 inch.
 - 3. Slat Finish: One color.
 - a. Ionized Coating: Antistatic, dust-repellent, baked enamel finish
- B. Headrail: Formed steel, zinc plated by hot-dip or electro plate galvanization, minimum .019 inch thick, long edges returned or rolled; fully enclosing operating mechanisms on three sides and ends; capacity for one blind per headrail, unless otherwise indicated on Drawings. Headrail to be 1 inch by 1 inch up to a maximum of 1 inch by one inch by 1 ½ inches. Adjustable end braces to be provided at ends of headrails to provided tight fit against jambs.
 - 1. Finish Color Characteristics: Match color, texture, pattern, and gloss of louver slats.
- C. Bottom Rail: Formed-steel tube, minimum .020 inch thick sheet steel for channel shape or 0.018 inch for oval or lock seam with metal capped ends, top contoured to match crowned shape of louver slat and bottom contoured for minimizing light gaps; with enclosed and protected ladders and tapes to prevent their contact with sill. Bottom rail to be electro galvanized with baked enamel finish.
- D. Maximum Light Blocking Blinds: Designed for eliminating all visible light gaps if slats are tilted closed; with tight tape spacing indicated and slats with minimal-sized rout holes for ladders hidden and placed near back edge for maximum slat overlap; with headrail and bottom rail extended and formed for light-tight joints between rail and adjacent slats or construction.
- E. Tilt Control: Consisting of enclosed steel or nylon lubricated worm gear mechanism. Tilt rod supports shall bear in low friction bushings slip clutch preventing overrotation, and solid steel linkage rod, for the following operation:
 - 1. Tilt Operation: Manual with rigid clear plastic wand minimum 0.2" diameter.
 - 2. Length of Tilt Control: Length required for bottom of bar to be at 60 inches above floor.
 - 3. Tilt: Full.
- F. Lift Operation: Manual, cord lock; locks pull cord to stop blind at any position in ascending or descending travel.
- G. Ladders: Evenly spaced to prevent long-term louver sag.
 - 1. Braided polyester string with two horizontal threads interbraided with verticals at each horizontal.
 - 2. Ladder spacing: 20 inches on center maximum with end ladder maximum 6 ½ inches from end of slats
- H. Cords: Braided polyester, 1.4 mm diameter with minimum breaking strength of 130 lbs.
- I. Stringing; blinds shall be strung such that the pull force measured in pounds required to raise the last six inches to a fully open position shall not exceed the following: 45 multiplied times the blind width in inches multiplied times the blind length in inches the sum of which is divided by 14,400.

- J. Mounting to permit easy removal and replacement without damaging blind or adjacent surfaces and finishes; with spacers and shims required for blind placement and alignment indicated.
- K. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard.
 - 1. Blinds at glazed door lites and side lites to be provided with hold down brackets.
- L. Colors, Textures, Patterns, and Gloss: As selected by Architect from manufacturer's full range. Blinds and other components to be provided in colors as selected for various areas of the project. Refer to I-001 for Interior Finishes Schedule.
- M. All headrails to be furnished with permanent printed label on the inside indicating the contractors name, date of assembly, manufacturers name, product model number and date of installation.

2.3 HORIZONTAL LOUVER BLIND FABRICATION

- A. Product Safety Standard: Fabricate horizontal louver blinds to comply with WCMA A 100.1 including requirements for corded, flexible, looped devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:
 - 1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which blind is installed less 1/4 inch per side or 1/2 inch total, plus or minus 1/8 inch. Length equal to head-to-sill dimension of opening in which blind is installed less 1/4 inch, plus or minus 1/8 inch, less than head to sill dimension of opening in which each blind is installed.
- C. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.
 - 1. Lift-and-Tilt Mechanisms: With permanently lubricated moving parts.
- D. Mounting and Intermediate Brackets: Designed for removal and reinstallation of blind without damaging blind and adjacent surfaces, for supporting blind components, and for bracket positions and blind placement indicated.
- E. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to brackets and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.
- F. Color-Coated Finish:
 - 1. Aluminum: For components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.
- G. Component Color: Provide rails, cords, ladders, and exposed-to-view metal and plastic matching or coordinating with slat color, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install horizontal louver blinds level and plumb, aligned and centered on openings, and aligned with adjacent units according to manufacturer's written instructions.
 - 1. Locate so exterior slat edges are not closer than 1 inch from interior faces of glass and not closer than 1/2 inch from interior faces of glazing frames through full operating ranges of blinds.
 - 2. Install mounting and intermediate brackets to prevent deflection of headrails.
 - 3. Install with clearances that prevent interference with adjacent blinds, adjacent construction, and operating hardware of glazed openings, other window treatments, and similar building components and furnishings.

3.3 ADJUSTING

- A. Adjust horizontal louver blinds to operate free of binding or malfunction through full operating ranges.

3.4 CLEANING AND PROTECTION

- A. Clean horizontal louver blind surfaces after installation according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer that ensures that horizontal louver blinds are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged horizontal louver blinds that cannot be repaired in a manner approved by Architect before time of Substantial Completion.

END OF SECTION 122113

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SECTION 123530 - RESIDENTIAL CASEWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes solid wood cabinets.
- B. Related Requirements:
 - 1. Section 061000 "Rough Carpentry" for wood blocking for anchoring casework.
 - 2. Section 092216 "Non-Structural Metal Framing" for reinforcements in metal-framed partitions for anchoring casework.
 - 3. Section 123661.16 "Solid Surfacing Countertops."

1.3 DEFINITIONS

- A. Concealed Surfaces of Casework: Surfaces not usually visible after installation, including sleepers, web frames, dust panels, bottoms of drawers, and ends of casework installed directly against and completely concealed by walls or other casework, and tops of wall cabinets and utility cabinets.
- B. Exposed Surfaces of Casework: Surfaces visible when doors and drawers are closed, including visible surfaces in open cabinets or behind glass doors.
- C. Semiexposed Surfaces of Casework: Surfaces behind opaque doors or drawer fronts, including interior faces of doors, interiors and sides of drawers, and bottoms of wall cabinets.

1.4 COORDINATION

- A. Coordinate layout and installation of blocking and reinforcement in partitions for support of casework.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components, and profiles and finishes for casework.
 - 2. Include rated capacities, operating characteristics, profiles, and finishes for hardware.

- B. Shop Drawings: For residential casework.
 - 1. Include plans, elevations, details, and attachments to other work.
 - 2. Show materials, finishes, filler panels, and hardware.
 - 3. Indicate manufacturer's catalog numbers for casework.
- C. Samples: For casework and hardware finishes.
- D. Samples for Initial Selection: For casework and hardware finishes.
- E. Samples for Verification: For the following:
 - 1. Casework Finishes: **8-by-10-inch** Samples for each type of casework finish.
 - 2. Hardware: One full-size Sample of each type of exposed hardware in each finish required.
 - 3. Base Cabinet: One full-size, **16-inch-** wide, finished base cabinet complete with hardware, doors, and drawers but without countertop.
 - 4. Wall Cabinet: One full-size, **12-inch-** wide, finished wall cabinet complete with hardware, doors, and adjustable shelves.
 - 5. Full-Size Samples: Maintain at Project site during construction in an undisturbed condition as a standard for judging the completed Work. Unless otherwise indicated, approved sample units may become part of the completed Work if in undisturbed condition at time of Substantial Completion. Notify Architect of their exact locations.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Product Certificates: For casework.

1.7 QUALITY ASSURANCE

- A. Certified Wood: Provide an invoice including vendor's chain-of-custody number, product cost, and entity being invoiced.
- B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install casework until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- B. Established Dimensions: Where casework is indicated to fit to other construction, establish dimensions for areas where casework is to fit. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Provide fillers and scribes to allow for trimming and fitting.

- C. Field Measurements: Where casework is indicated to fit to existing construction, verify dimensions of existing construction by field measurements before fabrication and indicate measurements on Shop Drawings. Provide fillers and scribes to allow for trimming and fitting.
- D. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before enclosing them, and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 CABINETS

- A. Quality Standard: Provide cabinets that comply with KCMA A161.1.
 - 1. KCMA Certification: Provide cabinets with KCMA's "Certified Cabinet" seal affixed in a semiexposed location of each unit and showing compliance with KCMA A161.1.
- B. Regional Materials: Manufacture wood products within **100 miles** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles** of Project site.
- C. Certified Wood: Certify wood products as "FSC Pure" or "FSC Mixed Credit" in accordance with FSC STD-01-001 and FSC STD-40-004.
- D. Door and Drawer Face Style: Flush overlay; faces cover cabinet fronts .
 - 1. Door and Drawer Fronts: Solid-wood stiles and rails, **5/8 inch** thick, with **3/4-inch-** thick, solid-wood center panels.
- E. Cabinet Style: Frameless.
- F. Exposed Cabinet End Finish: Wood veneer .
- G. Cabinet End Construction: **5/8-inch-** thick particleboard or **1/2-inch-** thick plywood .
- H. Cabinet Tops and Bottoms: **5/8-inch-** thick particleboard or **1/2-inch-** thick plywood .
 - 1. Fully support in rabbets in and secure to end panels , front frame, and back rail.
- I. Back, Top, and Bottom Rails: **3/4-by-2-1/2-inch** solid wood, interlocking with end panels and rabbeted to receive top and bottom panels. Back rails secured under pressure with glue and with mechanical fasteners.
- J. Wall-Hung-Unit Back Panels: **3/16-inch-** thick plywood fastened to rear edge of end panels and to top and bottom rails.
- K. Base-Unit Back Panels: **3/16-inch-** thick plywood fastened to rear edge of end panels and to top and bottom rails.
- L. Front Frame Drawer Rails: **3/4-by-1-1/4-inch** solid wood mortised and fastened into face frame.

- M. Drawers: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
 - 1. Join subfronts, backs, and sides with glued dovetail joints.
 - 2. Subfronts, Backs, and Sides: ~~3/4-inch~~ thick solid wood .
 - 3. Bottoms: ~~1/4-inch~~ thick plywood .
- N. Shelves: ~~3/4-inch~~ thick particleboard or ~~5/8-inch~~ thick plywood .
- O. Joinery: Rabbet backs flush into end panels and secure with concealed mechanical fasteners. Connect tops and bottoms of wall cabinets and bottoms and stretchers of base cabinets to ends and dividers with mechanical fasteners. Rabbet tops, bottoms, and backs into end panels.
- P. Factory Finishing: Finish cabinets at factory.

2.2 CABINET MATERIALS

- A. Hardwood Lumber: Kiln dried to 7 percent moisture content.
- B. Softwood Lumber: Kiln dried to 10 percent moisture content.
- C. Composite Wood Products: Verify products are made using ultra-low-emitting formaldehyde resins, as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products," or are made with no added formaldehyde.
- D. Hardwood Plywood: HPVA HP-1.
- E. Particleboard: ANSI A208.1, Grade M-2.
 - 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.
- F. Particleboard: Straw-based particleboard complying with requirements in ANSI A208.1, Grade M-2, except for density.
- G. MDF: Medium-density fiberboard, ANSI A208.2, Grade MD.
 - 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.
- H. Hardboard: ANSI A135.4, Class 1 tempered.
 - 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.
- I. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- J. Exposed Materials:

1. Exposed Wood Species: Maple .
 - a. Select materials for compatible color and grain. Do not use two adjacent exposed surfaces that are noticeably dissimilar in color, grain, figure, or natural character markings.
 - b. Staining and Finish: As selected by Architect from manufacturer's full range.
2. Solid Wood: Clear hardwood lumber of species indicated, free of defects.

K. Semiexposed Materials: Unless otherwise indicated, provide the following:

1. Solid Wood: Sound hardwood lumber, selected to eliminate appearance defects. Same species as exposed surfaces or stained to be compatible with exposed surfaces.

L. Concealed Materials: Solid wood or plywood, of any hardwood or softwood species, with no defects affecting strength or utility; particleboard; MDF; or hardboard.

2.3 CABINET HARDWARE

- A. General: Manufacturer's standard units complying with BHMA A156.9, of type, size, style, material, and finish .
- B. Pulls: Back-mounted decorative pulls .
 1. Back mounted, "European bar-style" pull with brushed nickel finish. Provide Atlas Homewares Skinny Linea Pull 5", or approved equal.
- C. Hinges: Concealed European-style, self-closing hinges .
- D. Drawer Guides: Epoxy-coated-metal, self-closing drawer guides; designed to prevent rebound when drawers are closed; with nylon-tired, ball-bearing rollers; and complying with BHMA A156.9, Type B05011 or Type B05091.
- E. Door and Drawer Bumpers: Self-adhering, clear silicone rubber.
 1. Doors: Provide one bumper at top and bottom of closing edge of each swinging door.
 2. Drawers: Provide one bumper on back side of drawer front at each corner.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements, and other conditions affecting performance of casework.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install casework with no variations in adjoining surfaces; use concealed shims. Where casework abuts other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match casework.
- B. Install casework without distortion so doors and drawers fit the openings, are aligned, and are uniformly spaced. Complete installation of hardware and accessories as indicated.
- C. Install casework level and plumb to a tolerance of **1/8 inch in 8 feet**.
- D. Fasten casework to adjacent units and to backing.
 - 1. Fasten wall cabinets through back, near top and bottom, and at ends not more than **16 inches** o.c.
 - a. Fasteners: No. 10 wafer-head screws sized for not less than **1-1/2-inch** penetration into wood framing, blocking, or hanging strips .

3.3 ADJUSTING AND CLEANING

- A. Adjust hardware so doors and drawers are centered in openings and operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.
- B. Clean casework on exposed and semiexposed surfaces. Touch up as required to restore damaged or soiled areas to match original factory finish, as approved by Architect.

END OF SECTION 123530

SECTION 123661.16 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Solid surface material countertops.
 - 2. Solid surface material backsplashes.
 - 3. Solid surface material end splashes.
 - 4. Solid surface material apron fronts.
 - 5. Solid surface window sills.

1.3 ACTION SUBMITTALS

- A. Product Data: For countertop and window sills.
- B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
 - 1. Show locations and details of joints.
 - 2. Show direction of directional pattern, if any.
- C. Samples for Initial Selection: For each type of material exposed to view.
- D. Shop Drawings: For window sills and countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures, toilet accessories and other items installed in countertops.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data for Fabricator: Provide AWI Quality Certification Program certificate for fabricator.
- B. Qualification Data for Installer: Provide AWI Quality Certification Program certificate for installer.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of countertops.
- B. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and execution.
 - 1. Build mockup of typical countertop
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.
- B. Condition solid surface material to average prevailing humidity conditions in installation areas and examine and complete work as required, including removal of packing before installation.

1.8 COORDINATION

- A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID-SURFACE-MATERIAL WINDOW SILLS

- A. Window sills: 1/2-inch- (12.7-mm-) thick, solid surface material with bullnosed edge.
- B. Fabrication: Fabricate sills in one piece unless otherwise indicated. Comply with solid-surface-material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

2.2 WINDOW SILL MATERIALS

- A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SFSL-1.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Avonite Surfaces.

- b. DuPont; Corian.
 - c. Formica Corporation.
 - d. LG Hausys America; Hi-Macs.
 - e. Wilsonart International.
2. Type: Provide Standard Type unless Special Purpose Type is indicated.
3. Colors and Patterns: Refer to Drawings for Interior Finishes Legend. The Interior Finishes Legend identifies Basis-of-Design Products for the purpose of establishing colors, patterns and percentages of field and accent colors. The Basis-of-Design products do not preclude the use of other acceptable products provided all requirements and specifications are met.

2.3 SOLID SURFACE COUNTERTOP MATERIALS

- A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.
 1. Basis-of-Design: Subject to compliance with requirements, provide products indicated on the Finish Schedule, or comparable products as approved by the Architect:
 - a. Colors and Patterns: As indicated on the Finish Schedule.
 2. Type: Provide Standard type unless Special Purpose type is indicated.
- B. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.4 COUNTERTOP FABRICATION

- A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WT's "Architectural Woodwork Standards."
 1. Grade: Premium.
- B. Configuration:
 1. Front: Straight, slightly eased at top.
 2. Backsplash: Straight, slightly eased at corner.
 3. End Splash: Matching backsplash.
- C. Countertops: Provide minimum 1/2-inch- thick, solid surface material on 3/4-inch-thick plywood with 1-1/2-inch-thick front edge built up with same solid surface material.
- D. Aprons: Provide minimum 1/2-inch thick, solid surface material turned down with bull-nose edging.
- E. Backsplashes: 1/2-inch- thick, solid surface material.
- F. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.
- G. Joints: Fabricate countertops without joints if possible.
- H. Joints: Where required, fabricate countertops in sections for joining in field, with joints at locations as approved by the Architect.
 1. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long would result, unless unavoidable.
 2. Splined Joints: Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints. Make width of cuts slightly more than thickness of splines to provide snug fit. Provide at least three splines in each joint.
- I. Cutouts and Holes:
 1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
 - a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.
 2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
 3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.5 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by solid surface material manufacturer.
- B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."
- C. Countertop Support Bracket: Load capacity 450 lbs. per pair, clear anodized aluminum; provide Rakks EH- Inside Wall Mount with face plate or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.
- B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- C. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
 - 1. Install metal splines in kerfs in countertop edges at joints. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
 - 2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.
- D. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- E. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.
- F. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
- G. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

3.3 WINDOW SILL INSTALLATION

- A. Install window sills level to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m).
- B. Align adjacent surfaces and, using adhesive in color to match window sill, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
 - 1. Install window sills to comply with manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

END OF SECTION 123661.16

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SECTION 220500 – PLUMBING GENERAL REQUIREMENTS

A. GENERAL

1. Scope of Work
 - a. The Contractor shall provide all materials, equipment and labor necessary to install and set into operation a complete plumbing system as shown on the engineering drawings and as specified herein.
2. Quality Assurance
 - a. See the General and Supplementary General Conditions.
 - b. All work shall be in accordance with State Code and Underwriter's Regulations. Minimum requirements shall be the State Plumbing Code.
 - c. Wherever the words "Approved", "Approval", or "Approved Equal" appear, it is intended that items other than the model numbers specified shall be subject to the approval of the Engineer.
 - d. "Provide" as used herein shall mean that the Contractor responsible shall furnish and install said item or equipment. "Furnish" as used herein shall mean that the Contractor responsible shall acquire and make available said item or equipment and that installation shall be by others. "Install" as used herein shall mean that the Contractor responsible shall make installation of items or equipment furnished by others.
 - e. All material and equipment that the Contractor proposes to substitute in lieu of those specified shall be submitted to the Engineer ten (10) days before the bid date for evaluation. The submittal shall include a full description of the material or equipment and all pertinent engineering data required to substantiate the equality of the proposed item to that specified. Items that are submitted for approval after this date will not be accepted. Section 01600 of the General Conditions will be followed for substitutions after award of the contract.
3. Submittals
 - a. See General and Supplementary General Conditions.
 - b. Within twenty days after notification of the award of the Contract and written notice to begin work, the Contractor shall submit to the Architect/Engineer for approval a detailed list of equipment and material which he proposes to use. Items requiring submittal data for approval will be noted at this time. Six (6) sets of submittal data shall be provided for approval
 - c. Each submittal shall bear the approval of the Contractor indicating that he has reviewed the data and found it to meet the requirements of the specifications as well as space limitations and other project conditions. The submittals shall be clearly identified showing project name, manufacturer's catalog number, and all necessary performance and fabrication data. Detailed submittal data shall be provided when items are to be considered as substitutions for specified items. Acceptance for approval shall be in writing from the Engineer.
 - d. The Contractor shall submit to the Engineer a set of accurately marked-up plans indicating all changes encountered during the construction. Final payment will be contingent upon receipt of these as-built plans.

- e. The Contractor shall furnish four (4) bound sets of maintenance and operating instructions as outlined in Paragraph C, (Execution), Item #6, of this specification section.
 - f. The Contractor shall submit to the Owner all certificates required for operating the system in compliance with the plans and specifications.
- 4. Product Delivery, Storage and Handling
 - a. All material and equipment shall be delivered and unloaded by the Contractor within the project site as noted herein or as directed by the Owner.
 - b. The Contractor shall protect all material and equipment from breakage, theft, or weather damage. No material or equipment shall be stored on the ground.
 - c. The material and equipment shall remain the property of the Contractor until the project has been completed and turned over to the Owner.
- 5. Work Conditions and Coordination
 - a. The Contractor shall review the electrical plans to establish points of connection and the extent of electrical work to be provided in his Contract. A licensed electrician shall perform all electrical work.
 - b. Electrical work shall be in accordance with State codes, and as specified in Division 16 contained herein.
 - c. Pipe chases required for installation of work shall be provided by the General Contractor unless otherwise noted. This Contractor shall be responsible for coordinating the location of all required chases.
 - d. All work shall be coordinated with other trades. Cutting of new work and subsequent patching shall be at the Contractor's expense at no extra cost to the Owner.
- 6. Guarantee
 - a. Where items of equipment or material carry a manufacturer's warranty for any period in excess of twelve (12) months, then the manufacturer's warranty shall apply for that particular piece of equipment or material. The contractor shall replace such defective equipment or materials, without cost to the owner, within the manufacturers warranty period.
 - b. The contractor shall unconditionally guarantee materials and workmanship against patent defects arising from faulty materials, faulty workmanship or negligence for a period of twelve (12) months following the final acceptance of the work and shall replace such defective materials or workmanship without cost to the owner.
 - c. Additionally, the contractor shall guarantee materials and workmanship against latent defects arising from faulty materials, faulty workmanship or negligence which is hidden or not readily apparent to the owner at the time of final acceptance and which is discovered by the owner within six (6) years following final acceptance of the work. The contractor shall replace such defective materials or workmanship without cost to the owner.

B. PRODUCT

1. Materials and equipment shall be new, unless noted otherwise, of the highest grade and quality and free from defects or other imperfections. Material and equipment found defective shall be removed and replaced at the Contractor's expense.
2. The Contractor shall provide nameplates for identification of all equipment, switches, panels, etc. The nameplates shall be laminated phenolic plastic, black front and back with white core, white engraved letters (1/4" minimum) etched into the white core. Nameplates shall be fastened with pan head tapping screws.

C. EXECUTION

1. Inspection
 - a. This Contractor shall examine the areas of completed work and shall insure that no defects or errors are present which would result in the poor application or installation of subsequent work.
2. Installation
 - a. All work shall be performed in a manner indicating proficiency in the trade.
 - b. All pipes shall be either parallel to building walls or plumb where installed in a vertical position and shall be concealed when located in architecturally finished areas.
 - c. Any cutting or patching required for installation of this Contractor's work shall be kept to a minimum. Written approval shall be required by the Architect/Engineer if cutting of primary structure is involved.
 - d. All finishing shall be by the General Contractor.
 - e. The Contractor shall lay out and install his work in advance of pouring concrete floors or walls. He shall furnish all sleeves to the General Contractor for openings through poured masonry floors or walls, above grade, required for passage of all pipes required to support his equipment.
 - f. All fixtures shall be accurately roughed in according to the manufacturer's installation dimensions so that no offset adaptors, flexible connections or other improvising are necessary. All incorrect work shall be torn out and corrected and walls and floors patched.
 - g. Connections to cold water, soil and waste lines shall be made at locations shown on the Drawings.
3. Performance
 - a. The Contractor shall perform all excavation and backfill operations necessary for installation of his work.
 - b. Rock excavation shall be defined in the Supplementary General Conditions. Unless specifically stated, neither rock excavation nor a unit price for rock excavation shall be required in the bid.
4. Erection
 - a. All support steel, angles, channels, pipes or structural steel stands and anchoring devices that may be required to rigidly support or anchor material and equipment shall be provided by this Contractor.
5. Adjust and Clean

- a. All equipment and installed materials shall be thoroughly clean and free of all dirt, oil, grit, grease, etc.
 - b. Factory painted equipment shall not be repainted unless damaged areas exist. These areas shall be touched up with a material suitable for intended service. In no event shall nameplates be painted.
 - c. At a scheduled meeting, the Contractor shall instruct the Owner or the Owner's representative in the operation and maintenance of all equipment installed under his Contract.
6. Maintenance and Operating Manual
- a. The Contractor shall prepare four (4) copies of a manual describing the proper maintenance and system operation. This manual shall not consist of standard factory printed data intended for dimension or design purposes (although these may be included), but shall be prepared to describe this particular job. This manual shall include the following:
 - 1) Index and page numbers.
 - 2) Certificate of substantial completion.
 - 3) A summary sheet of warranties with the dates noted and a copy of all warranties.
 - 4) List of all subcontractors and suppliers with names, addresses and phone numbers.
 - 5) Certified testing and balancing report.
 - 6) All submittal data and shop drawings.
 - b. The O & M manuals shall be installed in 3 ring heavy back note books with the name of the building and the words, "Operations and Maintenance Manuals" permanently affixed to the cover and spine.
 - c. The operating and maintenance manuals shall be submitted to the Engineer (2) weeks before the pre-final inspection, for approval. When the manuals are considered complete by the Engineer, they will be turned over to the Owner for their permanent use.

END OF SECTION 220500

SECTION 220513 - ELECTRICAL WORK IN PLUMBING CONTRACT

A. GENERAL

1. This Contractor shall be responsible for the entire control system and control connections to all equipment installed as part of his contract.
2. Wiring from disconnect switches, junction boxes, panelboard circuit breakers, etc. up to plumbing equipment shall be by the electrical contractor. Refer to details on plans for connections to equipment from starter/disconnects.
3. All power and control wiring shall be in conduits.
4. All electrical work shall be performed by a licensed electrician.
5. All electrical work shall be in accordance with the State Building Code and all its supplements and the latest edition of the National Electrical Code.

B. PRODUCT

1. All motor starters, disconnects, switches, relays, conduits, conductors, etc. that are required for a complete electrical power and/or control system shall conform to the requirements set forth by NEC.
2. Refer to the plans for the type, size and electrical characteristics of the starters, disconnects, switches, relays, conductor and conduits.
3. All conductors and conduits shall be sized as noted on the plans or as required per NEC.

C. EXECUTION

1. All motor starters, disconnects, and switches shall be installed on or as close to the equipment they are serving as possible, or where shown on the plans.
2. Control wiring electrical connection to equipment subject to vibration which develops objectionable noises shall be made from the conduit system with short lengths of flexible "Liquid- Tite" conduit. Connection to other equipment shall be made with rigid conduit.
3. Control wiring conduits shall be run in a concealed space such as wall cavities, ceiling cavities, etc. except in the mechanical rooms where conduit may be run exposed.

END OF SECTION 220513

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220523 – PLUMBING VALVES

A. GENERAL

1. Valves shall be installed where indicated or required.
2. Insofar as possible, all valves shall be by the same manufacturer.
3. All valves stored on project site shall have ports closed.
4. Valves shall serve dual functions as shut-off and balancing valves.
5. Valves shall have an adjustable set point with locking mechanism which will permit closing of the valve and reopening of the valve to the previously determined set point.

B. PRODUCT

1. Isolation/Shutoff valves up to and including 3" in line size shall be full port, forged brass ball valves with threaded ends, Watts Series FBV-1 or approved equivalent.
2. Isolation/Shutoff valves 4" and larger shall be full port, 125# class, epoxy coated cast iron, flanged ball valves suitable for potable water service, FDA approved, Watts Series G-4000-FDA or approved equivalent
3. Provide stem extensions, as necessary, to accommodate piping insulation.

C. EXECUTION

1. All flanged connections shall be gasketed.
2. In no case shall raised face flanges be bolted to flat face flanges.
3. All valve stems shall be accessible and in no case shall valve stems be installed below horizontal.
4. The Contractor shall set in service all valves to operating conditions as part of his Contract.
5. The contractor shall provide 1" diameter brass valve tags for all valves.
6. The contractor shall provide ceiling markers for ceilings above lay-in ceiling.
7. The contractor shall provide a framed valve chart.

END OF SECTION 220523

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220529 – PLUMBING HANGERS AND SUPPORTS

A. GENERAL

1. This Section includes all hangers and supports, etc. as may be required to provide a complete piping system.
2. The actual arrangement of the piping shall follow the general locations shown on the Drawings, such that clearances, line drainage, etc. shall be maintained.
3. Refer to specification Section 221000 for piping.

B. PRODUCT

1. Piping shall be as stated in Piping Section(s).
2. Hangers and supports shall be as manufactured by B-Line Systems, Inc., PHD Manufacturing, Empire, or Modern Support Devices.

C. EXECUTION

1. In no case shall this Contractor be allowed to cut or reduce the specified covering to allow the application of a smaller hanger than required.
2. Hangers shall be spaced as dictated by North Carolina Plumbing Code.
3. Hangers shall be provided at each change in direction.
4. Vertical risers shall be supported at each floor, 5 feet on center, and/or at changes in direction of pipe.
5. Do not support piping from bar joist bridging and/or roof deck.

END OF SECTION 220529

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SECTION 220700 – PIPE INSULATION

A. GENERAL

1. The Contractor shall insulate hot water supply and return, and cold water piping as specified below.
2. All insulation, linings, coverings and adhesives shall have a flame spread classification of 25 or less and a smoke developed rating of not more than 50, except for exposed outside piping.

B. PRODUCT

1. All hot and cold water piping (unless otherwise noted) shall be insulated with 1" thick fibrous glass materials with factory applied cover. All hot and cold water piping located in unconditioned spaces shall be insulated with 1 1/2" thick fibrous glass materials with factory applied cover. Cover shall be embossed vapor barrier, laminated with pressure sealing cap adhesive.
2. Closed cell insulation, of equal R-value may be used in lieu of fiberglass where concealed in walls. Insulation joints are to be sealed per manufacturer's recommendations. Taped joints will not be accepted. Insulation shall be finished with a fire retardant coating to attain proper fire rating.
3. All exposed piping in finished areas and equipment spaces shall have an additional layer of Kraft paper with vapor sealing tape followed by 8oz. /sq.yd. canvas cloth wrap, glued with two coats of sizing. Canvas shall be coated twice with Foster fireproof lagging to assure flame and smoke spread ratings.

C. EXECUTION

1. Insulation shall be installed in accordance with manufacturer's recommendations.
2. All exterior piping insulation above grade shall be provided with a protective aluminum jacket with a factory-applied asphalt and Kraft paper moisture barrier. Aluminum jackets shall be cross-ripped (longitudinally corrugated) for strength. Aluminum jackets shall be not less than 0.106" thick and shall be secured with aluminum or stainless steel screw; not more than 8" apart.
3. All piping exposed outdoors shall be wrapped with electric trace before insulation is applied.
4. Any pipe covered prior to leak testing shall be exposed at contractor expense.
5. All piping shall be provided with identification in accordance with ANDI A13.1-1981 standards. Markers shall be located at each wall, floor, and ceiling penetration, and at every 25ft (10 feet in mechanical rooms). Markers shall be fully legible from floor level showing medium contained in pipe, and direction of flow. Wording on markers shall be as follows:
 - a) "Domestic Cold Water Supply".
 - b) "Domestic Hot Water Supply".
6. Provide sheet metal saddle at each hanger. Provide wood blocking at each saddle.

END OF SECTION 220700

221000 – PIPE AND PIPE FITTINGS

A. GENERAL

1. This section includes all pipe, pipe fittings, hangers, and supports, etc. as may be required to provide a complete water plumbing system.
2. The actual arrangement of the piping shall follow the general locations shown on the drawings, such that clearances, line drainage, etc. shall be maintained.
3. Refer to specification Section 220523.
4. Refer to specification Section 220529.
5. Refer to specification Section 220700.

B. PRODUCT

1. Domestic Water Pipe and Pipe Fittings
 - a) Copper Pipe
 1. Water piping above grade shall be Type “L” hard drawn copper. Water piping below grade shall be Type “K” soft drawn. Pipe shall conform to ASTM B-88 Specification.
 2. Water piping fittings shall be sweat or grooved type wrought copper conforming the ANSI-B16.22, ASME B16.18, or ASTM B584 Specification.
 3. Use silver solder or grooved couplings (Victaulic Style 607) on all piping.
 4. All piping systems shall be hydrostatically tested at 150 psi for a period of 48 hours without loss of pressure. Any leaks that occur shall be repaired and another test started
 2. Storm, Sanitary Waste and Vent Pipe and Pipe Fittings
 - a) Cast Iron Pipe
 1. Building sanitary sewer and storm line below grade shall be service weight cast iron, with hub and spigot type joints, with neoprene “Charlotte” seal.
 2. Building sanitary sewer, storm, and vent lines above grade shall be cast iron with no hub joints with stainless steel bands.
 3. Cast iron fittings to conform to piping specifications.
 4. Waste pipe shall be tested at each floor. A test tee will be installed below each floor and pipe will be filled with water for a height of 10’ above finished floor. The pipe shall be gas and water tight. Water shall stand in the system for a period of 3 hours without evidence of leakage.
 5. Horizontal roof drain leaders above grade shall be insulated with 1” fiberglass.
 6. Waste piping, above ceilings, from floor drains shall be insulated with 1” fiberglass.
 - b) PVC Pipe

1. Building sanitary sewer and storm lines below grade shall be schedule 40 PVC-DWV conforming to ASTM D-2665-68.
2. Building sanitary sewer, storm, and vent lines above grade shall be schedule 40 PVC-DWV conforming to ASTM D-2665-68.
3. PVC fittings to conform to piping specifications.
4. Joints for PVC piping shall be made using the piping manufacturer's approved solvent cement.
5. Waste pipe shall be tested at each floor. A test tee will be installed below each floor and pipe will be filled with water for a height of 10' above finished floor. The pipe shall be gas and water tight. Water shall stand in the system for a period of 3 hours without evidence of leakage.
6. PVC piping is not permitted in return air plenums.
7. PVC piping is not permitted for dishwasher waste. Cast iron piping is to be used.

C. EXECUTION

1. Sleeves shall be provided wherever pipes pass through walls, floors, and ceilings. Sleeves shall be Schedule 40, black steel, ½" in diameter larger than the pipe or insulation on the pipe. Sleeves through floors shall be caulked and made watertight.
2. In pipe chases, the Contractor shall provide for suspension of all piping from the structure. Do not allow piping to rub against masonry when expanding and contracting.
3. Close and protect open ends of piping until final connections are made. Such closing shall be made with fittings which cannot be easily removed. Caps or plugs shall be required at all times during construction so that no pipes are left open at the end of any day's work, even though continuation is expected the next day.
4. All piping and equipment installed under this Contract shall be tested in the presence of the Engineer or a designated representative of the Owner, and the proper Plumbing Inspector, proved tight for the periods stated above, or longer if required by the Inspector. Engineer shall be given 48 hour written notification of all tests.
5. No plumbing system or part thereof shall be covered or concealed until after it has been tested and approved. If such work has been covered or concealed before testing, it shall be exposed for testing.
6. All water piping shall be sterilized with chlorine, 50 milligrams per liter, and held for a 24-hour period, after which the system shall be flushed prior to being put into service. During the flushing of the system, all flush valves shall be thoroughly flushed out to insure the removal of sediment, pipe dope, etc., from water lines and flush valves, removing such working parts of the flush valves as may be deemed necessary. The system shall be drained and flushed sufficiently to provide chlorine residue of 0.2 ppm or less.

END OF SECTION 221000

221119 – PIPING SPECIALTIES

A. GENERAL

1. This Section includes miscellaneous items required for a complete plumbing system.

B. PRODUCT

1. Escutcheons shall be chrome plated, spring type, on all pipes passing through walls and ceilings in finished areas. Floor escutcheons shall be cast brass, chrome plated, with set screw.
2. Stops shall be compression type, chrome plated, angle or straight way pattern on all fixtures, hot and cold water supply. On service sinks, use brass gate valve as specified.
3. Flashing for vents through the roof shall be two-piece type, 16 ounce copper counter flashing and base flashing, or a two-piece type, 4 pound lead counter flashing and base flashing. The base flashing shall be installed by the General Contractor with the roof system.
4. Pipe anchors for rough-in use shall be "Rapid Rough" products. Use for anchoring rough-in of all hot and cold water connections for all lavatories, sinks and other wall connected fixtures.
5. Insulating couplings shall be V-line, as manufactured by Walter Vallett or approved equal.
6. Shock absorbers shall be of all stainless steel construction and in conformance with P. D. I. Standard WH201. Shock absorbers shall be installed as noted at the locations shown on the plans and shall be totally accessible. Where there are no shock absorbers noted or shown on the plans, 18 inch air chamber type shock absorbers shall be installed at the hot and cold water supply to each fixture.
7. Unions shall be bronze body with packless brass ground joints. Wrought iron pipe unions shall be malleable iron, ground joint with bronze to iron seat.

C. EXECUTION

1. Escutcheons shall be of sufficient size to cover outside diameter of the pipe or the insulation of the pipe.
2. Vent flashing shall extend down at least 4 inches from the top of the pipe. Flashing shall extend at least 12 inches in all directions from the pipe and shall be parallel to the roof line.
3. Pipe anchors for rough-in use shall be installed to hold pipes securely in alignment, according to the manufacturer's rough-in dimensions. Remove these devices after the wall is built around the pipes.
4. Unions shall be installed as shown on the plans, and where required, to disconnect piping for future replacement or repairs.
5. Dielectric unions shall be installed at hot water heaters and at any junction of dissimilar metal pipes.

END OF SECTION 221119

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224000 – PLUMBING FIXTURES

A. GENERAL

1. Provide plumbing fixtures as scheduled on the drawings.
2. All fixtures shall be by one manufacturer insofar as possible.
3. Submit shop drawings on the following:
 - a. Fixtures
 - b. Floor drains and cleanouts
 - c. Trim
4. All fixtures are to be white.

B. PRODUCT

1. Products approved for use on this shall be as follows:
 - a. Fixtures: Kohler, American Standard, Eljer, Zurn, Toto, Crane
 - b. Stainless steel sinks: Elkay, Just
 - c. Flush Valves: Sloan, Delaney, Zurn
 - d. Floor drains and cleanouts: Zurn, Smith, and Josam.
 - e. Trim: Kohler, American Standard, Eljer, Chicago Faucets, T & S Brass and Bronze, Delta, Symmons, Sloan, Delaney, Stern-Williams, McGuire, Brasscraft, Cambridge Brass, Speakman, Zurn, Moen.

C. EXECUTION

1. Fixtures and carriers shall be installed in accordance with the manufacturer's recommendations.
2. All fixtures, drains, traps, etc. shall be set plumb and level.
3. All handicapped fixtures and trim shall be installed in accordance with the State Building Code, latest edition.
4. Provide trap primer and required piping on all floor drains.
5. All fixtures are to be water saving type.
6. Provide vandal-proof options for all fixtures used by public. This includes screws, aerators, and showerheads.

END OF SECTION 224000

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230500 – GENERAL MECHANICAL REQUIREMENTS

A. GENERAL

1. Scope of Work
 - a. The Contractor shall provide all materials, equipment and labor necessary to install and set into operation a complete mechanical systems as shown on the engineering drawings and as specified herein.
2. Quality Assurance
 - a. See the General and Supplementary General Conditions.
 - b. All work shall be in accordance with State Code and Underwriter's Regulations. Minimum requirements shall be the State Plumbing, Mechanical, Gas, and Energy Code.
 - c. Wherever the words "Approved", "Approval", or "Approved Equal" appear, it is intended that items other than the model numbers specified shall be subject to the approval of the Engineer.
 - d. "Provide" as used herein shall mean that the Contractor responsible shall furnish and install said item or equipment. "Furnish" as used herein shall mean that the Contractor responsible shall acquire and make available said item or equipment and that installation shall be by others. "Install" as used herein shall mean that the Contractor responsible shall make installation of items or equipment furnished by others.
 - e. All material and equipment that the Contractor proposes to substitute in lieu of those specified, shall be submitted to the Engineer ten (10) days before the bid date for evaluation. The submittal shall include a full description of the material or equipment and all pertinent engineering data required to substantiate the equality of the proposed item to that specified. Items that are submitted for approval after this date will not be accepted. The General Conditions will be followed for substitutions after award of the contract.
3. Submittals
 - a. See General and Supplementary General Conditions.
 - b. Within twenty days after notification of the award of the Contract and written notice to begin work, the Contractor shall submit to the Architect/Engineer for approval a detailed list of equipment and material which he proposes to use. Items requiring submittal data for approval will be noted at this time. Six (6) sets of submittal data shall be provided for approval
 - c. Each submittal shall bear the approval of the Contractor indicating that he has reviewed the data and found it to meet the requirements of the specifications as well as space limitations and other project conditions. The submittals shall be clearly identified showing project name, manufacturer's catalog number, and all necessary performance and fabrication data. Detailed submittal data shall be provided when items are to be considered as substitutions for specified items. Acceptance for approval shall be in writing from the Engineer.

- d. The Contractor shall submit to the Engineer a set of accurately marked-up plans indicating all changes encountered during the construction. Final payment will be contingent upon receipt of these as-built plans.
 - e. The Contractor shall furnish four (4) bound sets of maintenance and operating instructions as outlined in Paragraph C, (Execution), Item #6, of this specification section.
 - f. The Contractor shall submit to the Owner all certificates required for operating the system in compliance with the plans and specifications.
4. Product Delivery, Storage and Handling
- a. All material and equipment shall be delivered and unloaded by the Contractor within the project site as noted herein or as directed by the Owner.
 - b. The Contractor shall protect all material and equipment from breakage, theft, or weather damage. No material or equipment shall be stored on the ground.
 - c. The material and equipment shall remain the property of the Contractor until the project has been completed and turned over to the Owner.
5. Work Conditions and Coordination
- a. The Contractor shall review the electrical plans to establish points of connection and the extent of electrical work to be provided in his Contract. All electrical work shall be performed by a licensed electrician.
 - b. Electrical work shall be in accordance with State codes, and as specified in Division 16 contained herein.
 - c. Pipe chases required for installation of work shall be provided by the General Contractor unless otherwise noted. This Contractor shall be responsible for coordinating the location of all required chases.
 - d. All work shall be coordinated with other trades. Cutting of new work and subsequent patching shall be at the Contractor's expense at no extra cost to the Owner.
6. Guarantee
- a. Where items of equipment or material carry a manufacturer's warranty for any period in excess of twelve (12) months, then the manufacturer's warranty shall apply for that particular piece of equipment or material. The contractor shall replace such defective equipment or materials, without cost to the owner, within the manufacturers warranty period.
 - b. The contractor shall unconditionally guarantee materials and workmanship against patent defects arising from faulty materials, faulty workmanship or negligence for a period of twelve (12) months following the final acceptance of the work and shall replace such defective materials or workmanship without cost to the owner.
 - c. The contractor shall provide a five year compressor warranty for all refrigeration compressors from date of system acceptance.
 - d. Additionally, the contractor shall guarantee materials and workmanship against latent defects arising from faulty materials, faulty workmanship or negligence

which is hidden or not readily apparent to the owner at the time of final acceptance and which is discovered by the owner within six (6) years following final acceptance of the work. The contractor shall replace such defective materials or workmanship without cost to the owner.

B. PRODUCT

1. Materials and equipment shall be new, unless noted otherwise, of the highest grade and quality and free from defects or other imperfections. Material and equipment found defective shall be removed and replaced at the Contractor's expense.
2. The Contractor shall provide nameplates for identification of all equipment, switches, panels, etc. The nameplates shall be laminated phenolic plastic, black front and back with white core, white engraved letters (1/4" minimum) etched into the white core. Nameplates shall be fastened with pan head tapping screws.

C. EXECUTION

1. Inspection
 - a. This Contractor shall examine the areas of completed work and shall insure that no defects or errors are present which would result in the poor application or installation of subsequent work.
2. Installation
 - a. All work shall be performed in a manner indicating proficiency in the trade.
 - b. All pipes shall be either parallel to building walls or plumb where installed in a vertical position and shall be concealed when located in architecturally finished areas.
 - c. Any cutting or patching required for installation of this Contractor's work shall be kept to a minimum. Written approval shall be required by the Architect/Engineer if cutting of primary structure is involved.
 - d. All finishing shall be by the General Contractor.
 - e. The Contractor shall lay out and install his work in advance of pouring concrete floors or walls. He shall furnish all sleeves to the General Contractor for openings through poured masonry floors or walls, above grade, required for passage of all pipes required to support his equipment.
 - e. All fixtures shall be accurately roughed in according to the manufacturer's installation dimensions so that no offset adaptors, flexible connections or other improvising are necessary. All incorrect work shall be torn out and corrected and walls and floors patched.
3. Performance
 - a. The Contractor shall perform all excavation and backfill operations necessary for installation of his work.

- b. Rock excavation shall be defined in the Supplementary General Conditions. Unless specifically stated, neither rock excavation nor a unit price for rock excavation shall be required in the bid.
- 4. Erection
 - a. All support steel, angles, channels, pipes or structural steel stands and anchoring devices that may be required to rigidly support or anchor material and equipment shall be provided by this Contractor.
- 5. Adjust and Clean
 - a. All equipment and installed materials shall be thoroughly clean and free of all dirt, oil, grit, grease, etc.
 - b. Factory painted equipment shall not be repainted unless damaged areas exist. These areas shall be touched up with a material suitable for intended service. In no event shall nameplates be painted.
 - c. At a scheduled meeting, the Contractor shall instruct the Owner or the Owner's representative in the operation and maintenance of all equipment installed under his Contract.
- 6. Maintenance and Operating Manual
 - a. The Contractor shall prepare four (4) copies of a manual describing the proper maintenance and system operation. This manual shall not consist of standard factory printed data intended for dimension or design purposes (although these may be included), but shall be prepared to describe this particular job. This manual shall include the following:
 - 1) Index and page numbers.
 - 2) Certificate of substantial completion.
 - 3) A summary sheet of warranties with the dates noted and a copy of all warranties.
 - 4) List of all subcontractors and suppliers with names, addresses and phone numbers.
 - 5) Certified testing and balancing report.
 - 6) All submittal data and shop drawings.
 - b. The O & M manuals shall be installed in 3 ring heavy back note books with the name of the building and the words, "Operations and Maintenance Manuals" permanently affixed to the cover and spine.
 - c. The operating and maintenance manuals shall be submitted to the Engineer (2) weeks before the pre-final inspection, for approval. When the manuals are considered complete by the Engineer, they will be turned over to the Owner for their permanent use.

END OF SECTION 230500

SECTION 230513 – ELECTRICAL WORK IN MECHANICAL CONTRACT

A. GENERAL

1. This Contractor shall be responsible for the entire control system and control connections to all equipment installed as part of his contract.
2. Wiring from disconnect switches, junction boxes, panelboard circuit breakers, etc. up to mechanical equipment shall be by the electrical contractor. Final electrical connections to mechanical equipment shall be by this contractor.
3. All power and control wiring shall be in conduits.
4. All electrical work shall be performed by a licensed electrician.
5. All electrical work shall be in accordance with the State Building Code and all its supplements and the latest edition of the National Electrical Code.

B. PRODUCT

1. All motor starters, disconnects, switches, relays, conduits, conductors, etc. that are required for a complete electrical power and/or control system shall conform to the requirements set forth by NEC.
2. Refer to the plans for the type, size and electrical characteristics of the starters, disconnects, switches, relays, conductor and conduits.
3. All conductors and conduits shall be sized as noted on the plans or as required per NEC.

C. EXECUTION

1. All motor starters, disconnects, and switches shall be installed on or as close to the equipment they are serving as possible, or where shown on the plans.
2. Electrical connection to equipment subject to vibration which develops objectionable noises shall be made from the conduit system with short lengths of flexible "Liquid- Tite" conduit. Connection to other equipment shall be made with rigid conduit.
3. Conduits shall be run in a concealed space such as wall cavities, ceiling cavities, etc. except in the mechanical rooms where conduit may be run exposed.

END OF SECTION 230513

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SECTION 230593 - TESTING AND BALANCING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Testing, Adjusting, and Balancing:
 - 1. Air condition equipment, including air distribution devices, supply ducts, air handling units, condensing units, fans, coils, and related equipment.
 - 2. Hydronic systems, including pumps, water distribution systems, chillers, boilers, heat exchangers, coils, and related equipment.

1.02 REFERENCES

- A. American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE)
 - 1. Standard 111-2008 – Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-conditioning and Refrigeration Systems.
 - 2. Applications Handbook 2019, Chapter 39 – Testing, Adjusting, and Balancing
- B. Testing, Adjusting and Balancing Bureau (TABB) – International Standards for Environmental Systems Balance.
- C. Sheet Metal and Air Conditioning Contractors' National Standards for Total System Balance.
- D. Associated Air Balance Council (AABC) – National Standards for Total System Balance.
- E. National Environmental Balancing Bureau (NEBB) – Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems.

1.03 DEFINITIONS

- A. Adjusting: Varying of system flow by modifying settings of dampers and valves, in combination with varying fan speeds to obtain optimum operating conditions for the entire system.
- B. Balancing: Proportioning of air and hydronic flows through system mains, branches and terminal devices using standardized procedures to obtain specified air or hydronic flow while imposing the least amount of restriction on the HVAC system.
- C. Testing: Use of specialized and calibrated instruments to measure temperatures, pressures, rotational speeds, electrical characteristic, air and hydronic flow in velocities or quantities used in evaluating the performance of an HVAC system.

1.04 COORDINATION

- A. The testing, adjusting and balancing Contractor shall coordinate his work with the mechanical system and temperature control system installing Contractors to accomplish coordination and verification of system operation and readiness for testing, adjusting and balancing.
- B. Coordinate and assist CxP with all verification activities including providing all required sampling data necessary for the commissioning process.

1.05 SUBMITTALS

- A. Qualification Statements:

1. Submit company's certification documents, including:
2. Contractor Certification:
 - a. Supervisor Certification
 - b. Technician Certification
3. Submit name of testing agency to Owner within thirty (30) days on Notice to Proceed.
4. Submit list of projects completed by testing agency of similar size, scope and equipment. Include name of Contractor and building Owner contacts.
5. Submit a certification letter stating that the TAB agency is an independent entity not owned in part or in whole by any subcontractor employed on the current project.

B. Reports:

1. Deficiency Report: Following examination of installed system, prior to balancing, submit report indicating system deficiencies that would prevent proper testing, adjusting and balancing of systems and equipment to meet specified performance.
2. TAB Report: Submit a copy of the complete testing, adjusting and balancing report to FMC Project Manager and RECS Atlanta Staff Engineer via email when it becomes available. Report shall include any drawings indicating air outlets, thermostats and equipment identified to correspond with data sheets.
 - a. Reports shall be on TABB/SMACNA (NEBB or AABC), forms that indicate information addressing each of the testing methods, readings and adjustments.

C. Closeout Submittals:

1. Provide complete copy of testing, adjusting and balancing report. Include report in operation and maintenance manual.

1.06 QUALITY ASSURANCE

A. Qualifications:

1. Testing and balancing shall be performed by a testing agency who specializes in testing, adjusting and balancing of heating, ventilating, air-moving equipment, air-conditioning systems and hydronic systems, and has a minimum of one (1) year experience.
2. Testing agency shall have successfully completed a minimum of five (5) projects, similar in size and scope.
3. Testing agency shall be a certified member of TABB (AABC and/or NEBB).
4. Maintain a copy of applicable standards at the project site.

B. Certifications:

1. TAB Technician shall be certified by a nationally recognized certifying agency (AABC and/or NEBB).

C. Perform total system balance in accordance with Testing, Adjusting and Balancing Bureau (TABB) – Quality Assurance Program for Environmental Systems Balance, and (AABC National Standards for Field Measurement and Instrumentation and/or NEBB Quality Assurance Program – Conformance Certification).

1.07 PROJECT CONDITIONS

- A. Testing, adjusting and balancing shall commence after the HVAC systems installation is complete and in working order. Associated areas of general construction shall be in place including interior and exterior doors, windows, walls, ceilings and existing conditions.**

1.08 SPECIAL WARRANTY

- A. Provide warranty for period of ninety (90) days following physical occupancy of building, during which time the Owner may request a re-check of up to 10% of total number of terminals, or resetting of any outlet, coil or device listed in the test report. This period of time shall be no longer than 180 days after submission of the completed report.
- B. Warranty shall meet the requirements of the following program(s):
 - 1. TABB – Quality Assurance Program
 - 2. AABC – National Performance Guarantee
 - 3. NEBB – Conformance Certification

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

- A. Prior to commencing testing, adjusting and balancing of environmental system(s), verify the following conditions; if deficiencies are evident, submit Deficiency Report to Engineer. Do not begin testing, adjusting and balancing of environmental system until deficiencies have been remedied.
 - 1. Systems are started and operating in a safe and normal condition.
 - 2. Temperature control systems are installed, complete, and operable.
 - 3. Automatic and manual dampers are operable and fully open.
 - 4. Thermal overload protection is in place for fans, pumps, chillers and other equipment.
 - 5. Start up air filters are removed.
 - 6. Final filters are clean and properly installed.
 - 7. Duct and fan systems are clean.
 - 8. Fans are rotating correctly.
 - 9. Fire and volume dampers are in place and open.
 - 10. Air coils fins are cleaned and combed.
 - 11. Access doors are closed and duct end caps are in place.
 - 12. Air outlets are installed and connected.
 - 13. Hydronic systems are pressure tested, flushed, filled and properly vented.
 - 14. Leak testing on duct system has been performed in accordance with SMACNA Standards, or as specified.
 - 15. Pumps are rotating correctly.
 - 16. (Start-up/construction) strainers have been removed and all permanent strainers are clean and in place.
 - 17. Gauges and/or test parts are properly located for balancing.
 - 18. Service and balance valves are fully open.

3.01 SITE TOLERANCES

- A. Air Handling Systems: Adjust to within plus 10 percent of outlet total plus allowable leakage rate.
- B. Air Outlets and Inlets: Adjust to within plus or minus 10 percent of design for the space.
- C. Hydronic Systems: Adjust to within plus or minus 10 percent of design flow.

- D. Hydronic Terminal Devices: Adjust to within plus or minus 10 percent of design flow.

3.02 AIR SYSTEMS PROCEDURE

- A. Adhere to the following procedure:

1. TABB – HVAC Testing, Adjusting and Balancing International Standards; with particular focus on the following chapters:
 - a. Preliminary TAB procedures
 - b. General air systems TAB procedures
 - c. TABB procedures for specific (VAV, CAV, Multizone, Dual duct, etc.) air systems
2. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) HVAC Systems – Testing, Adjusting and Balancing.
3. NEBB – Procedural standards for TAB of environmental systems.
4. AABC – National standards for total systems balance.

- B. Minimum air procedures should include the following:

1. Test and adjust fan RPM to design requirements.
2. Test and record motor full load nameplate rating and actual ampere draw.
3. Test and record system static pressures, fan suction and discharge.
4. Adjust all main supply and return air duct to within tolerances listed in this section of work.
5. Test and adjust each diffuser, grille and register. Reading and tests of diffusers, grilles and registers shall include design velocity (FPM) and adjusted velocity, design CFM and adjusted CFM.
6. Test and record outside, mixed air, and discharge temperatures (D.B. for heating cycle, D.B. and W.B. for cooling cycle).
7. In coordination with the ATC contractor, set adjustments of automatically operated dampers to operate as specified, indicated and/or noted.
8. Test and adjust air handling and distribution systems to provide required or design supply, return, outside and exhaust air quantities within design tolerance.
9. In air systems employing filters, blank off filter area to simulate a pressure drop that is midway between that of a clean filter and that of a dirty filter.
10. Make air velocity measurements in ducts by Pitot tube traverse entire cross-sectional area of duct in accordance with SMACNA equal area method or Log Linear method.
11. Measure air quantities at all air inlets and outlets.
12. Use volume control devices to regulate air quantities only to the extent that adjustments do not create objectionable air motion or sound levels.
13. Vary total system air quantities by adjustments of fan speeds. Provide drive changes recommendations. Vary branch air quantities by damper regulation.
14. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for loading of filters and coils.
15. Adjust outside air automatic dampers. Outside air, return air and exhaust dampers for design conditions within specified tolerances.
16. Where modulating dampers or economizers are provided, take and record measurement at full return air, minimum outside air and 100 percent outside are mode of operation.

17. Verify and record, in the T&B Report, “K” factors for all VAV air terminal devices and air flow stations.

3.03 HYDRONIC SYSTEM PRESSURE

- A. Adhere to the following procedure:
 1. Testing, Adjusting and Balancing Bureau (TABB) – International Standards for Environmental Systems Balance
 2. SMACNA – HVAC Testing, Adjusting and Balancing International Standards; with particular focus on the following chapter:
 - a. Hydronic TAB procedures
 3. NEBB – Procedural standards for TAB of environmental systems.
 4. AABC – National standards for total systems balance.
- B. Hydronic balancing shall include the following minimum data:
 1. Prepare itemized equipment schedules, listing all heating and/or cooling elements and equipment in the systems to be balanced. List, in order on equipment schedules, by pump or zone according to the design, all heating and/or cooling elements, all zone balancing valves, and circuit pumps, ending with the last items of equipment or transfer element in the respective zone or circuit. Include on schedule sheet column titles listing the location, type of element or apparatus, design conditions and measured conditions. Prepare individual pump report sheets for each zone or circuit.
 2. Use calibrated Venturi tubes, orifices, metered fittings, pressure gages and direct reading instrumentation to determine flow rates for system balance. Where flow-metering devices are not installed, flow balance in temperature difference across various heat transfer elements in the system is acceptable.
 3. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
 4. Adjust hydronic distribution systems by means of balancing cocks, valves and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
 5. Test pumps and adjust flow. Record the following on pump report sheets:
 - a. Suction and discharge pressure;
 - b. Running amps and brake horsepower of pump motor under full flow and no flow conditions;
 - c. Pressure drop across pump in feet of water and total GMP pump is handling under full flow conditions.
 6. Where available pump capacity is less than total flow requirements or individual system parts, proportional balancing must be performed.

3.04 ADJUSTING

- A. Recorded data shall represent actual measured or observed conditions.
- B. Permanently mark setting of valves, dampers and other adjustment devices allowing for settings to be restored. Set and lock memory stops.
- C. Leave systems in proper working, replacing belt guards, closing access doors, closing doors to electrical switch boxes and restoring thermostats to specified settings.

- D. Areas or rooms designed to maintain positive, negative or balanced air pressures with respect to adjacent spaces, as indicated by the design air quantities, require special attention. Adjust fan drives, distribution dampers, terminals and controls to maintain indicated pressure relationship.

END OF SECTION 230593

230700 – INSULATION

A. GENERAL

1. This section includes insulation for piping, ductwork, and equipment, as shown on the plans.
2. All insulation, linings, coverings, and adhesives shall have a flame spread classification of 25 or less and a smoke developed rating of not more than 50.
3. Insulation shall be Certainteed, Owens Corning, or Johns-Manville.

B. PRODUCT

1. Duct
 - a) Unless otherwise noted in the drawings all rectangular and round air conditioning supply, return, exhaust, and outside air duct shall be externally insulated with 2" thick, 3/4 lb. density foil scrim Kraft jacketed insulation. Joints shall be wrapped with a minimum of 3" wide FSK band of insulation to prevent any possible leakage and condensation. Ducts with widths over 30" shall be further secured on the underside with mechanical fasteners on 18" maximum centers.
 - b) In addition to the duct wrap specified in B1.a of this specification, all low pressure rectangular supply and return ductwork shall be lined for 15 feet downstream from air handling unit (or up to and including the first 90 degree elbow). Duct liner shall be 1" thick, 2lb. dense, Shuller Permorate Linacoustic HP, or approved equivalent. Coat all exposed leading edges and transverse joints with a fire retardant adhesive.
 - c) Duct sizes shown are actual duct dimension. Where ductwork is lined, as noted above, the duct insulation thickness shall be added to the listed ductwork dimensions for final duct size.
 - d) Duct routed outside the building shall be insulated with minimum R-8 fiberglass. All joints shall be sealed with mastic prior to insulating. Apply final skin of sheet metal and seal weather tight.
 - e) Duct board shall be 2" thickness rigid Fiberglas Owens/Corning or equal, ASTM C 612, 3 pounds per cubic foot density, with Foil reinforced jacket. The board shall be attached with field applied perforated base pins or weld pins applied on 12" centers. Finish shall be 8oz canvas jacket, totally sized with Foster 81-42W or equal lagging adhesive. Corner board shall be used on all edges.
2. Piping
 - a) All condensate drain piping, make-up water piping, all refrigerant suction piping, and all refrigerant piping exposed on the exterior of the building shall be insulated with 1.5" wall tubular closed cell elastomeric insulation with all joints butted and cemented tight. Insulation shall be Rubatex R-180-FS or equal.

C. EXECUTION

1. Insulation shall be installed in accordance with manufacturer's recommendations.
2. All exterior piping insulation above grade shall be provided with a protective aluminum jacket with a factory-applied asphalt and kraft paper moisture barrier. Aluminum jackets shall be cross-crimped (longitudinally corrugated) for strength. Aluminum jackets shall be not less than 0.106" thick and shall be secured with aluminum or stainless steel screw; not more that 8" apart.
3. All piping exposed outdoors shall be wrapped with electric trace before insulation is applied.
4. No chilled water shall be allowed to circulate prior to completion of insulation.
5. Any pipe covered prior to leak testing shall be exposed at contractor expense.

END OF SECTION 230700

SECTION 230900 – INSTRUMENTATION AND CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. This section describes the scope of work for the Facility Management and Control System that must be installed by a qualified FCMS Contractor and integrated to the Enterprise Server by the Enterprise Developer. This section also coordinates the responsibilities of the Mechanical and Electrical trade contractors pertaining to control products or systems, furnished by each trade, and that will be integrated by this Division.
- B. All labor, material, equipment and software not specifically referred to herein or on the plans, that is required to meet the functional intent of this specification, shall be provided without additional cost to the Owner.
- C. It is the owner's goal to implement an open system that will allow products from various suppliers to be integrated into a unified system in order to provide flexibility for expansion, maintenance, and service of the system. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s).

1.2 SCOPE OF WORK

- A. The Facility Management and Control System (FMCS) shall be comprised of Network Area Controller or Controllers (NAC) within each facility. The NAC shall connect to the owner's local or wide area network, depending on configuration. Each User shall configure a dashboard view of the pertinent data and this view shall be saved for later use. Access to the system, either locally in each building, or remotely from a central site or sites, shall be accomplished through a standard Web browser, via the Internet and/or local area network. Each NAC shall communicate to LonMark/LonTalk (IDC), Bacnet (IBC), MODBUS and other open and legacy protocol systems/devices provided under this Division. In addition, from the controller(s) to the device(s) shall communicate to LonMark/LonTalk (IDC), Bacnet (IBC), MODBUS and other open and legacy protocol systems/devices provided under this Division. It is the owner's goal to eliminate any gateway or redundant device(s).
- B. The Facility Management and Control System (FMCS) as provided in this Division shall be a JACE that provides an open automation infrastructure, an open license, and is available from multiple systems integrators. JACE shall have capability to integrate diverse systems and devices (regardless of manufacturer, communication standard or software) into a unified platform that can be easily managed in real time over a secure network using a standard Web browser.
- C. The work provided in this specification shall be performed by two entities. The FMCS Contractor shall have overall responsibility for the Division work. The Enterprise Developer shall be appointed by the Owner and shall provide all work at the Enterprise Server level. Owner will

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oversee and provide procurement for Enterprise Developer services. See Section 1.3 for more detail on the division of work.

- D. All materials and equipment used shall be standard components. All systems and components shall have been thoroughly tested and proven in actual use for at least two years.
- E. All wiring shall be done in accordance with all local and national codes.

1.3 DIVISION OF WORK

- A. The FMCS contractor shall be responsible for all communicating thermostats, any miscellaneous controllers (IDC and IBC), control devices, control panels, controller programming, controller programming software, controller input/output and power wiring and controller network wiring specified to be provided in Division 23.
- B. The Division 26 (if applicable) contractors shall be responsible for all controllers Security NAC, control devices (BACnet, LONworks or Modbus), control panels, controller programming, controller programming software, controller input/output and power wiring and controller network wiring specified to be provided in Division 26. These devices shall be configured and commissioned by Division 26 contractors and later managed in the NAC by FMCS contractor.
- C. The FMCS contractor shall be responsible for the Network Area Controller(s) (NAC), software and programming of the NAC, graphical user interface software (GUI), User Configurable Dashboard software and connection of the NAC to the local or wide area network. FMCS shall also be responsible for development of all graphical screens, Web browser pages, setup of schedules, logs and alarms, and network management for all IDC or IBC devices provided in Division 23 and 26. IDC or IBC devices not provided by FMCS contractor shall be configured and commissioned by appropriate contractor and later managed in the NAC by FMCS contractor.
- D. For reasons of security and consistency, it is the owner's intention to divide the work defined in this section into two sections. Work performed at the NAC level and below shall be performed by a qualified FMCS Systems Integrator. All work provided at the Enterprise Server and between the server and other systems shall be provided by the owner appointed Enterprise Developer. The Enterprise Developer shall be responsible for the "learning" of the WBI (web browser graphics) from the NAC to the Enterprise Server, the configuration of the Periscope Dashboard software and the global integration strategies across NACs and other intelligent building systems. The Enterprise Developer shall also be responsible for all Security integration at the Server level, if applicable.

1.4 RELATED WORK SPECIFIED ELSEWHERE

- A. Products integrated and installed but not furnished under this section
 - 1. Project specific equipment

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- a. JACE-8000 w/ IO-34 and 4.10 software
- b. Wall Adapter – power supply for J-2..90-240 VAC 50/60 Hz. Wall Adaptor
- c. Web version of WorkPlace AX
- d. 8 Universal Inputs – 4 Form A Relay Outputs and 4 0-10 VDC Analog Outputs
- e. 16 Universal Inputs – 10 Form A Relay Outputs and 8 0-10 VDC Analog
- f. Veris meter (if applicable)
- g. Electric pulse meter (if applicable)
- h. Gas meter (if applicable)
- i. Water meter (if applicable)

1.5 QUALITY ASSURANCE

- A. The FMCS system shall be designed and installed, commissioned and serviced by factory trained personnel. Systems Integrator shall have an in-place support facility within 100 miles of the site with technical staff, spare parts inventory and necessary test and diagnostic equipment.
 - 1. The Systems Integrator shall provide full time, on site, experienced project manager for this work, responsible for direct supervision of the design, installation, start up and commissioning of the FMCS.
 - 2. The Bidder shall be regularly engaged in the manufacturing, installation and maintenance of FMCS systems and shall have a minimum of ten (10) years of demonstrated technical expertise and experience in the manufacture, installation and maintenance of FMCS systems similar in size and complexity to this project with a maintained service organization. Provide a list of 10 projects, similar in size and scope to this project, completed within the last five years.
- B. Materials and equipment shall be the catalogued products of manufacturers regularly engaged in production and installation of automatic temperature control systems and shall be manufacturer's latest standard design that complies with the specification requirements.
- C. All FMCS peer-to-peer network controllers, central system controllers and local user displays shall be UL Listed under Standard UL 916, category PAZX; Standard ULC C100, category UUKL7; and under Standard UL 864, categories UUKL, UDTZ, and QVAX and be so listed at the time of bid. All floor level controllers shall comply, at a minimum, with UL Standard UL 916 category PAZX; Standard UL 864, categories UDTZ, and QVAX and be so listed at the time of Bid.
- D. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.
- E. The manufacturer of the building automation system shall provide documentation supporting compliance with ISO-9002 (Model for Quality Assurance in Production, Installation, and Servicing) and ISO-14001 (The application of well-accepted business management principles to the environment). The intent of this specification requirement is to ensure that the products from the manufacturer are delivered through a Quality System and Framework that will assure consistency in the products delivered for this project.

- F. This system shall have a documented history of compatibility by design for a minimum of 15 years. Future compatibility shall be supported for no less than 10 years. Compatibility shall be defined as the ability to upgrade existing field panels to current level of technology, and extend new field panels on a previously installed network.
 - 1. Compatibility shall be defined as the ability for any existing field panel microprocessor to be connected and directly communicate with new field panels without bridges, routers or protocol converters.

1.6 SUBMITTALS

- A. Provide individuals experienced with the installation and startup of equipment related to this type of integration.
 - 1. Eight copies of shop drawings of the entire FMCS shall be submitted and shall consist of a complete list of equipment and materials, including manufacturers catalog data sheets and installation instructions. Shop drawings shall also contain complete wiring and schematic diagrams, software descriptions, calculations, and any other details required to demonstrate that the system has been coordinated and will properly function as a system. Terminal identification for all control wiring shall be shown on the shop drawings. The FMCS shall submit an architecture layout that depicts devices from the JACE to NAC down to the device level.
 - 2. A complete written Sequence of Operation shall also be included with the submittal package. The FMCS Systems Integrator shall coordinate data from other contractors supplying products and systems, as part of their package and shall provide catalog data sheets, wiring diagrams and point lists to the owner for proper coordination of work.
- B. Submittal shall also include a trunk cable schematic diagram depicting operator workstations, control panel locations and a description of the communication type, media and protocol. The FMCS Systems Integrator shall be responsible for integrating all network level devices into the overall trunk cable schematic diagrams for the entire Wide Area Network (WAN).
- C. Submittal shall also include a complete point list of all points to be connected FMCS by the Systems Integrator. System integrator shall provide necessary point lists, protocol documentation, and factory support information for systems provided in their respective divisions but integrated into the FMCS.
- D. Submittal shall also include a copy of each of the graphics developed for the Graphic User Interface including a flowchart (site map) indicating how the graphics are to be linked to one another for system navigation. The graphics are intended to be 80% - 90% complete at this stage with the only remaining changes to be based on review comments from the A/E design team and/or Owner. Submittal shall also include a copy of the expected Dashboard viewlets being provided for owner configuration. The owner will provide an example of an acceptable graphic template. Where a particular graphic template does not exist, the Integrator shall create a similar template and gain approval during submittal process.

- E. Upon completion of the work, provide a complete set of 'as-built' drawings and application software on compact disk. Drawings shall be provided as AutoCAD™ or Visio™ compatible files. Eight copies of the 'as-built' drawings shall be provided in addition to the documents on compact disk. Division 23 and 26 contractors shall provide as-builts for their portions of work. The FMCS Systems Integrator shall be responsible for as-builts pertaining to overall FMCS architecture and network diagrams. All as built drawings shall also be installed into the FMCS server in a dedicated directory.

1.7 SPECIFIC NOMENCLATURE

- A. Acronyms used in this specification are as follows:

FMCS	Facility Management and Control System
TCS	Temperature Control System
NAC	Network Area Controller
IDC	Interoperable Digital Lon Controller
FPC	Freely Programmable Lon Controllers
GUI	Graphical User Interface
WBI	Web Browser Interface
POT	Portable Operator's Terminal
PMI	Power Measurement Interface
DDC	Direct Digital Controls
LAN	Local Area Network
WAN	Wide Area Network
OOT	Object Oriented Technology
PICS	Product Interoperability Compliance Statement

1.8 SOFTWARE LICENCE AGREEMENT

- A. The Owner shall sign a copy of the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to Owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software.
- B. It is the owners express goal to implement an open system that will allow products from various suppliers to be integrated into a unified system in order to provide flexibility for expansion, maintenance, and service of the system. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s). In addition, the Owner shall receive ownership of all job specific configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job specific software code and documentation for all configuration and programming that is generated for a given project and/or configured for use with the NAC, FMCS Server(s), and any related LAN / WAN / Intranet and Internet connected routers and devices. Any and all required IDs and passwords for access to any component or software program shall be provided to the owner.

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1.9 DELIVERY, STORAGE AND HANDLING

- A. Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

1.10 JOB CONDITIONS

- A. Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to ensure that the Work will be carried out in an orderly fashion. It shall be this Systems Integrator's responsibility to check the Contract Documents for possible conflicts between his Work and that of other crafts in equipment location, pipe, duct and conduit runs, electrical outlets and fixtures, air diffusers, and structural and architectural features.

1.11 WARRANTY

- A. Provide all services, materials and equipment necessary for the successful operation of the entire FMCS for a period of one year after beneficial use.
- B. The adjustment, required testing, and repair of the system includes all computer equipment, transmission equipment and all sensors and control devices.
- C. With owner pre-approval, the on-line support services shall allow the local FMCS Systems Integrator to dial out over telephone lines to monitor and control the facility's building automation system. Pending owner approval, this remote connection to the facility shall be within 2 hours of the time that the problem is reported. This coverage shall be extended to include normal business hours, after business hours, weekends and holidays.
 - 1. If the problem cannot be resolved on-line by the local office, the national office of the building automation system manufacturer shall have the same capabilities for remote connection to the facility.
 - 2. If the problem cannot be resolved with on-line support services, the FMCS manufacturer shall dispatch the appropriate personnel to the job site to resolve the problem within a reasonable time frame.

1.12 ACCEPTABLE SYSTEM INTEGRATORS

- A. The FMCS Systems Integrator shall provide NAC hardware, software and DDC components. NAC hardware and software shall be the Vykon brand. The successful FMCS Systems Integrator shall not have password access to the Enterprise Server and shall be restricted to NAC access.
- B. The FMCS Systems Integrator shall have a technical support group accessible that is staffed with qualified personnel, capable of providing instruction and technical support service for networked control systems.

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- C. Acceptable Systems Integrators of the hardware and software components as specified herein are as follows:
 - 1. Vykon by Envirocon
 - 2. Vykon by Energy Automation Technologies
 - 3. Vykon by Brady

PART 2 - PRODUCTS

2.1 GENERAL

- A. The Facility Management Control System (FMCS) shall be comprised of a network of interoperable, stand-alone digital controllers, a computer system, graphical user interface software, printers, network devices and other devices as specified herein.
- B. The installed system shall provide secure password access to all features, functions and data contained in the overall FMCS.

2.2 OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURES

- A. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate ANSI/ASHRAE Standard 135-2001 BACnet, LonWorks technology, MODBUS, existing OPC if applicable, and other existing open and proprietary communication protocols if applicable in one open, interoperable system.
- B. The supplied computer software shall employ component-based technology (OOT) for representation of all data and control devices within the system. In addition, adherence to industry standards including ANSI / ASHRAE™ Standard 135-2001, BACnet and LonMark to assure interoperability between all system components is required. For each LonWorks device that does not have LonMark certification, the device supplier must provide an XIF file and a resource file for the device. For each BACnet device, the device supplier must provide a PICS document showing the installed device's compliance level. Minimum compliance is Level 3; with the ability to support data read and write functionality. Physical connection of BACnet devices shall be via Ethernet (BACnet Ethernet/IP,) and/or RS-485 (BACnet MSTP) as specified.
- C. All components and controllers supplied under this Division shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data shall not be acceptable.
- D. The supplied system must incorporate the ability to access all data using standard Web browsers without requiring proprietary operator interface and configuration programs. An Open DataBase Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on a supplier-installed server for all database access. Systems requiring proprietary database and user interface programs shall not be acceptable.

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- E. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network. Systems employing a "flat" single tiered architecture shall not be acceptable.
 - 1. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces.
 - 2. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.

2.3 NETWORKS

- A. The Local Area Network (LAN) shall be a 100 Megabits/sec Ethernet network supporting BACnet, Java, XML, HTTP, and OBIX for maximum flexibility for integration of building data with enterprise information systems and providing support for multiple Network Area Controllers (NACs), user workstations and, if specified, a local server.
- B. Local area network minimum physical and media access requirements:
 - 1. Ethernet; IEEE standard 802.3
 - 2. Cable; 100 Base-T, UTP-8 wire, category 5
 - 3. Minimum throughput; 100 Mbps.

2.4 NETWORK ACCESS

- A. Remote Access.

For Local Area Network installations the Owner shall provide a connection to the Internet to enable access via the customer's Intranet to a corporate server. FMCS Systems Integrator shall connect to IP drop provided by the Owner within 25 feet.

2.5 NETWORK AREA CONTROLLER (NAC)

- A. The FMCS Systems Integrator shall supply one or more Network Area Controllers (NAC) as part of this contract to manage devices/points in all specification sections. This division shall be required to integrate BACNet zone information provided by the Division 280000 Systems Integrator into the HVAC and Lighting Sequence of Operation. The number of NACs provided by this Systems Integrator is dependent on the type/quantity of devices and points. It is the responsibility of the FMCS Systems Integrator to coordinate with all Division contractors to determine the quantity and type of NACs needed to fulfill the operating sequences.
- B. The Network Area Controller (NAC) shall provide the interface between the LAN or WAN and the field control devices, and provide global supervisory control functions over the control devices connected to the NAC. It shall be capable of executing application control programs to provide:
 - 1. Calendar functions

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2. Scheduling
 3. Trending
 4. Alarm monitoring and routing
 5. Time synchronization
 6. Integration of LonWorks controller data and BACnet controller data
 7. Network Management functions for all LonWorks based devices
- C. The Network Area Controller must provide the following hardware features as a minimum:
1. Two Ethernet Ports – 10/100 Mbps
 2. One LonWorks Interface Port – 78KB FTT-10A (if applicable)
 3. Two RS-485 ports
 4. Flash memory for long term data backup (If battery backup or flash memory is not supplied, the controller must contain a hard disk with at least 1 gigabyte storage capacity)
 5. The NAC must be capable of operation over a temperature range of 32 to 122°F
 6. The NAC must be capable of withstanding storage temperatures of between 0 and 158°F
 7. The NAC must be capable of operation over a humidity range of 5 to 95% RH, non-condensing
- D. The NAC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 32 simultaneous users.
- E. NAC Alarm Notification and actions
1. The NAC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.
 2. The NAC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up telephone connection, or wide-area network.
 3. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but limited to:
 - a. To alarm
 - b. Return to normal
 - c. To fault
 4. Provide for the creation of a minimum of eight of alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc.
 5. Provide timed (schedule) routing of alarms by class, object, group, or node.

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6. Provide alarm generation from binary object “runtime” and /or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.
7. Control equipment and network failures shall be treated as alarms and annunciated.
8. Alarms shall be annunciated in any of the following manners as defined by the user:
 - a. Screen message text
 - b. Email of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on:
 1. Day of week
 2. Time of day
 3. Recipient
 - c. Pagers via paging services that initiate a page on receipt of email message
 - d. Graphic with flashing alarm object(s)
9. The following shall be recorded by the NAC for each alarm (at a minimum):
 - a. Time and date
 - b. Location (building, floor, zone, office number, etc.)
 - c. Equipment (air handler #, accessway, etc.)
 - d. Acknowledge time, date, and user who issued acknowledgement.
 - e. Number of occurrences since last acknowledgement.
10. Alarm actions may be initiated by user defined programmable objects created for that purpose.
11. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.
12. A log of all alarms shall be maintained by the NAC and/or a server (if configured in the system) and shall be available for review by the user.
13. Provide a “query” feature to allow review of specific alarms by user defined parameters.
14. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.
15. An Error Log to record invalid property changes or commands shall be provided and available for review by the user.

F. NAC Data Collection and Storage

1. The NAC shall have the ability to collect data for any property of any object and store this data for future use. See points list for required logs.
2. The data collection shall be performed by log objects, resident in the NAC that shall have, at a minimum, the following configurable properties:
 - a. Designating the log as interval or deviation.
 - b. For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.
 - c. For deviation logs, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.
 - d. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.
 - e. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.
3. All log data shall be archived to a database in the Enterprise Server and the data shall be accessed from a standard Web browser and the Periscope Dashboard.
4. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements.
5. All log data shall be available to the user in the following data formats:
 - a. HTML
 - b. XML
 - c. Plain Text
 - d. Comma or tab separated values
6. Systems that do not provide log data in HTML and XML formats at a minimum shall not be acceptable.
7. The NAC shall have the ability to archive its log data remotely to a server on the network. Provide the ability to configure the following archiving properties, at a minimum:
 - a. Archive on time of day
 - b. Archive on user-defined number of data stores in the log (buffer size)
 - c. Archive when log has reached its user-defined capacity of data stores
 - d. Provide ability to clear logs once archive.

G. NAC AUDIT LOG

1. Provide and maintain an Audit Log that tracks all activities performed on the NAC. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached its user-defined buffer size. Provide the ability to archive the log to a server. For each log entry, provide the following data:
 - a. Time and date
 - b. User ID
 - c. Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.

H. NAC DATABASE BACKUP AND STORAGE

1. The NAC shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time interval. Enterprise Developer shall coordinate with Owner to establish/implement a backup procedure.
2. Copies of the current database and, at the most recently saved database shall be stored in the NAC. The age of the most recently saved database is dependent on the user-defined database save interval.
3. The NAC database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

2.6 WEB BROWSER CLIENTS

- A. The system shall also allow use of an unlimited number of clients using a standard Web browser such as Internet Explorer™ or Netscape Navigator™. The system shall be capable of providing a rich user experience (including full use of the engineering toolset) through the use of java applets or a simple user interface using only HTML, CSS and JavaScript. Refer to Sequence of Operations for the client side display types that are required on this project.
- B. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function with the FMCS, shall not be acceptable.
- C. The Web browser shall provide the same view of the graphics, schedules, calendars, logs, etc as is provided by the Graphical User Interface. Systems that require different views or that require different means of interacting with objects such as schedules, or logs, shall not be permitted.
- D. The Web browser client shall support at a minimum, the following functions:
 1. User log-on identification and password shall be required. If an unauthorized user attempts access, a blank web page shall be displayed. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.

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2. Graphical screens developed for the GUI shall be the same screens used for the Web browser client (unless clearly stated in the sequence of operation). Any animated graphical objects supported by the GUI shall be supported by the Web browser interface. Enterprise Developer shall provide a FMCS Systems Integrator with a basis of performance/expectation for GUI. FMCS Systems Integrator shall use this standard graphic template or modify the graphics slightly to achieve the desired specification requirement/outcome.
3. Storage of the graphical screens shall be in the Network Area Controller (NAC) and these graphics shall be “learned” by the Enterprise Server.
4. Real-time values displayed on a Web page shall update automatically without requiring a manual “refresh” of the Web page.
5. Owner shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:
 - a. Modify common application objects, such as schedules, calendars, and set points in a graphical manner.
 1. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
 2. Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
 - b. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
 - c. View logs and charts
 - d. View and acknowledge alarms
 - e. Setup and execute SQL queries on log and archive information
6. The system shall provide the capability to specify a user’s (as determined by the log-on user identification) home page. Provide each specific user a defined home page based on their usage requirements. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.
7. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

2.7 SYSTEM PROGRAMMING

- A. The Graphical User Interface software (GUI) shall provide the ability to perform system programming and graphic display engineering as part of a complete software package. Access

to the programming functions and features of the GUI shall be through password access as assigned by the system administrator.

- B. A library of control, application, and graphic components shall be provided to enable the creation of all applications and user interface screens. Applications are to be created by selecting the desired control components from the library, dragging or pasting them on the screen, and linking them together using a built in graphical connection tool. Completed applications may be stored in the library for future use. Graphical User Interface screens shall be created in the same fashion. Data for the user displays is obtained by graphically linking the user display components to the application components to provide “real-time” data updates. Any real-time data value or component property may be connected to display its current value on a user display. Systems requiring a separate software tool to create applications and browser user interface displays shall not be acceptable.
- C. Programming Methods
 - 1. Provide the capability to copy component s from the supplied libraries, or from a user-defined library to the user’s application. Component shall be linked by a graphical linking scheme by dragging a link from one component to another. Component links will support one-to-one, many-to-one, or one-to-many relationships. Linked components shall maintain their connections to other objects regardless of where they are positioned on the page and shall show link identification for links to components on other pages for easy identification. Links will vary in color depending on the type of link; i.e., internal, external, hardware, etc.
 - 2. Configuration of each component will be done through the component’s property sheet using fill-in the blank fields, list boxes, and selection buttons. Requiring the use of custom programming, scripting language, or a manufacturer-specific procedural language for every component configuration will not be accepted.
 - 3. The software shall provide the ability to view the logic in a monitor mode. When on-line, the monitor mode shall provide the ability to view the logic in real time for easy diagnosis of the logic execution. When off-line (debug), the monitor mode shall allow the user to set values to inputs and monitor the logic for diagnosing execution before it is applied to the system.
 - 4. All programming shall be done in real-time. Systems requiring the uploading, editing, and downloading of database component s shall not be allowed.
 - 5. The system shall support component duplication within a customer’s database. An application, once configured, can be copied and pasted for easy re-use and duplication. All links, other than to the hardware, shall be maintained during duplication.

2.8 COMPONENT LIBRARIES

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- A. A standard library of components shall be included for development and setup of application logic, user interface displays, system services, and communication networks.
- B. The components in this library shall be capable of being copied and pasted into the user's database and shall be organized according to their function. In addition, the user shall have the capability to group components created in their application and store the new instances of these components in a user-defined library.
- C. In addition to the standard libraries specified here, the supplier of the system shall maintain an on-line accessible (over the Internet) library, available to all registered users to provide new or updated components and applications as they are developed.
- D. All control components shall conform to the control component specified in the BACnet specification.
- E. The component library shall include components to support the integration of devices connected to the Network Area Controller (NAC). At a minimum, provide the following as part of the standard library included with the programming software:
 - 1. LonMark/LonWorks devices. These devices shall include, but not be limited to, devices for control of HVAC, lighting, access, and metering. Provide LonMark manufacturer-specific components to facilitate simple integration of these devices. All network variables defined in the LonMark profile shall be supported. Information (type and function) regarding network variables not defined in the LonMark profile shall be provided by the device manufacturer.
 - 2. For devices not conforming to the LonMark standard, provide a dynamic component that can be assigned to the device based on network variable information provided by the device manufacturer. Device manufacturer shall provide an XIF file, resource file and documentation for the device to facilitate device integration.
 - 3. For BACnet devices, provide the following components at a minimum:
 - a. Analog In
 - b. Analog Out
 - c. Analog Value
 - d. Binary
 - e. Binary In
 - f. Binary Out
 - g. Binary Value
 - h. Multi-State In
 - i. Multi-State Out
 - j. Multi-State Value
 - k. Schedule Export
 - l. Calendar Export
 - m. Trend Export

- n. Device
- 4. For each BACnet component, provide the ability to assign the component a BACnet device and component instance number.
- 5. For BACnet devices, provide the following support at a minimum
 - a. Segmentation
 - b. Segmented Request
 - c. Segmented Response
 - d. Application Services
 - e. Read Property
 - f. Read Property Multiple
 - g. Write Property
 - h. Write Property Multiple
 - i. Confirmed Event Notification
 - j. Unconfirmed Event Notification
 - k. Acknowledge Alarm
 - l. Get Alarm Summary
 - m. Who-has
 - n. I-have
 - o. Who-is
 - p. I-am
 - q. Subscribe COV
 - r. Confirmed COV notification
 - s. Unconfirmed COV notification
 - t. Media Types
 - u. Ethernet
 - v. BACnet IP Annex J
 - w. MSTP
 - x. BACnet Broadcast Management Device (BBMD) function
 - y. Routing

2.9 LONWORKS NETWORK MANAGEMENT

- A. The Graphical User Interface software (GUI) shall provide a complete set of integrated LonWorks network management tools for working with LonWorks networks. These tools shall manage a database for all LonWorks devices by type and revision, and shall provide a software mechanism for identifying each device on the network. These tools shall also be capable of defining network data connections between LonWorks devices, known as “binding”. Systems requiring the use of third party LonWorks network management tools shall not be accepted.
- B. Network management shall include the following services: device identification, device installation, device configuration, device diagnostics, device maintenance and network variable binding.

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- C. The network configuration tool shall also provide diagnostics to identify devices on the network, to reset devices, and to view health and status counters within devices.
- D. These tools shall provide the ability to “learn” an existing LonWorks network, regardless of what network management tool(s) were used to install the existing network, so that existing LonWorks devices and newly added devices are part of a single network management database.
- E. The network management database shall be resident in the Network Area Controller (NAC), ensuring that anyone with proper authorization has access to the network management database at all times. Systems employing network management databases that are not resident, at all times, within the control system, shall not be accepted.

2.10 BACNet NETWORK MANAGEMENT

- A. The Network Area Controller shall support the integration of device data from BACNet TCP/IP or BACNet MSTP system devices. The connection to the BACNet system shall be via an RS485, or Ethernet IP as required by the device.
- B. Provide the required components in the library, included with the Graphical User Interface programming software, to support the integration of the Bacnet system data into the FMCS. Components provided shall include at a minimum:
 - 1. Read/Write BACNet AI Points
 - 2. Read/Write BACNet AO Points
 - 3. Read/Write BACNet AV Points
 - 4. Read/Write BACNet BI Points
 - 5. Read/Write BACNet BO Points
 - 6. Read/Write BACNet BV Points
- C. All scheduling, alarming, logging and global supervisory control functions, of the BACNet system devices, shall be performed by the Network Area Controller.
- D. The FMCS supplier shall provide a BACNet system communications driver. The equipment system vendor that provided the equipment utilizing BACNet shall provide documentation of the system’s interface and shall provide factory support at no charge during system commissioning
- E. BACnet Conformance:
 - 1. Logic controllers shall as a minimum support MS/TP BACnet LAN type. They shall communicate directly via this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 Kbps, as native BACnet devices. Logic controllers shall be of BACnet conformance class 3 and support all BACnet services necessary to provide the following BACnet functional groups:
 - a. Files Functional Group
 - b. Reinitialize Functional Group

c. Device Communications Functional Group

2. Refer to Section 22.2, BACnet Functional Groups, in the BACnet Standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

2.11 COMMUNICATING THERMOSTATS

- A. The manufacturer of the Thermostat hardware and software components must be primarily engaged in the manufacture of BAS as specified herein, and must have been so for a minimum of five (5) years.
- B. The manufacturer shall be ISO 9001:2000 certified. This is to insure that all manufacturing, design and support policies comply with a minimum quality assurance standard. Corporate quality assurance policies should be available for examination upon request by the owner or his agent.
- C. The manufacturer of the hardware and software components shall have a technical support group accessible via a toll free number that is staffed with qualified personnel, capable of providing instruction and technical support service for networked control systems.
- D. Acceptable providers of the Communicating Thermostat hardware and software components as specified herein are as follows. Acceptance as a product provider does not provide approval to be an acceptable FMCS Systems Integrator.
 - a. Reliable
 - b. ABB
 - c. Viconics
 - d. Distech Controls
 - e. Honeywell
 - f. Delta
- E. Communicating Thermostats shall be LON or BACNet thermostats. FMCS Systems Integrator shall standardize on a single protocol for all thermostats and IDC/IBCs (if non thermostat controllers are needed) provided, i.e. all controllers provided shall be of the same protocol. This does not necessarily apply to controllers provided in other sections of the specification as there may be limited choices, but when possible, standardize on a single protocol.

2.12 LON DEVICES (IDC)

- A. The manufacturer of the hardware and software components must be primarily engaged in the manufacture of BAS as specified herein, and must have been so for a minimum of five (5) years.

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- B. The manufacturer shall be ISO 9001:2000 certified. This is to insure that all manufacturing, design and support policies comply with a minimum quality assurance standard. Corporate quality assurance policies should be available for examination upon request by the owner or his agent.
- C. The manufacturer of the hardware and software components shall have a technical support group accessible via a toll free number that is staffed with qualified personnel, capable of providing instruction and technical support service for networked control systems.
- D. Acceptable manufacturers of the hardware and software components as specified herein are as follows. Acceptance as a product manufacturer does not provide approval to be an acceptable Systems Integrator.
 - a. Reliable
 - b. ABB
 - c. Viconics
 - d. Distech Controls
 - e. Honeywell
 - f. Delta

2.13 BACNET DEVICES (IBC)

- A. The manufacturer of the hardware and software components must be primarily engaged in the manufacture of BAS as specified herein, and must have been so for a minimum of five (5) years.
- B. The manufacturer shall be ISO 9001:2000 certified. This is to insure that all manufacturing, design and support policies comply with a minimum quality assurance standard. Corporate quality assurance policies should be available for examination upon request by the owner or his agent.
- C. The manufacturer of the hardware and software components shall have a technical support group accessible via a toll free number that is staffed with qualified personnel, capable of providing instruction and technical support service for networked control systems.
- D. Acceptable manufacturers of the hardware and software components as specified herein are as follows. Acceptance as a product manufacturer does not provide approval to be an acceptable Systems Integrator.
 - a. Reliable
 - b. ABB
 - c. Viconics
 - d. Distech Controls
 - e. Honeywell
 - f. Delta

2.14 LON/BACNET CONTROLLER(S) STANDARDS

- A. Where possible provide LON Controllers or BACNet Controllers that can meet the required sequence of operation and can be configured rather than custom programmed. All controllers shall be designed for easy installation and servicing including removable enclosures, removable terminals, and factory applied labels for all I/O. All internal points shall be fully supported by the Graphical User Interface (GUI), allowing the user to easily modify them and monitor them. All of the internal programming points (e.g. variables, constants, PID's, timers, inputs and outputs) shall be exposed to the network on dedicated network variable outputs.
- B. Performance Standards for Inputs - Provide software selectable universal inputs. Analog inputs - shall have the following minimum level of performance: 10 bit A to D resolution; manage thermistors with an accuracy of: $\pm 0.9^{\circ}\text{F}$, and a Potentiometer. For VAV Applications provide a differential pressure input sensor built in to the controller with a adjustable range of .05" to 2" H₂O (125-300PA) static pressure with a minimum accuracy of + or - 3%. Minimum response time shall be 0.5 seconds from input to output time.
- C. Performance Standards for Outputs – Analog outputs shall have the following minimum level of performance: Tri-mode Voltage of 0-10 VDC (linear), digital 0-12 VDC (off/on) or PWM. All analog outputs shall be equipped with an auto-reset fuse. Output Resolution shall be a minimum 8 bits digital / analog converter. Digital outputs shall be provided with a minimum of a triac output rated at 24VAC and 1 amp. All analog outputs and power supply shall be fuse protected
- D. Application Specific Controllers (ASC)- A controller designed through its I/O configuration and configurable control logic to be used for a specific type mechanical equipment. Typical applications are VAV boxes, Fan Coil Units, Roof Top Units, Unit Ventilators, Split DX Systems, Heat Pumps. Lighting Controls, etc. All ASC's shall conform to the LonMark or BACNet standards so long as such a standard exists for its intended application. The ASC shall allow the use of its spare I/O as dumb I/O to be shared over the network to NAC where a sequence of operation can be applied to the I/O. Such applications shall include but not be limited to exhaust fan control, heaters, light control, etc.
- E. Freely Programmable Controllers (FPC) shall be a controller designed for more complex sequences of operations such as built up AHU's, central plant operations, electrical monitoring, and control and management for chillers, boilers and generators. These FPCs are to allow for the flexibility of custom control programming to meet the needed sequences of operation.

2.15 MODBUS SYSTEM INTEGRATION

- A. The Network Area Controller shall support the integration of device data from Modbus RTU, Ascii, or TCP control system devices. The connection to the Modbus system shall be via an RS-232, RS485, or Ethernet IP as required by the device.

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- B. Provide the required components in the library, included with the Graphical User Interface programming software, to support the integration of the Modbus system data into the FMCS. Components provided shall include at a minimum:
 - 1. Read/Write Modbus AI Registers
 - 2. Read/Write Modbus AO Registers
 - 3. Read/Write Modbus BI Registers
 - 4. Read/Write Modbus BO Registers
- C. All scheduling, alarming, logging and global supervisory control functions, of the Modbus system devices, shall be performed by the Network Area Controller.
- D. The FMCS supplier shall provide a Modbus system communications driver. The equipment system vendor that provided the equipment utilizing Modbus shall provide documentation of the system's Modbus interface and shall provide factory support at no charge during system commissioning
- E. Provide a Modbus Interface to the following equipment:
 - 1. switchgear
 - 2. packaged pumping system
 - 3. building energy metering

2.16 THIRD PARTY INTEGRATION

- A. The Network Area Controller shall support the integration of device data from the existing control system. The connection to the existing system shall be via an RS-232 connection between the Network Area Controller and the existing control system {if applicable on this project}.
- B. Provide the required data points from the third party integration per sequence of operations and/or points list

2.17 SENSORS

- A. All control items, except thermostats, sensors and transmitters located in rooms shall be properly identified with engraved plastic nameplates permanently attached. Nameplates shall have white letters on a black background.
- B. Room thermostat, sensor and transmitter locations shall be coordinated to align vertically or horizontally with adjacent light switches or other control devices. Room thermostats and sensors shall be mounted with the bottom 5'-0" above the floor. Sensors installed in areas where they are subject to physical abuse (ex: gymnasiums) shall be furnished with protective type aspirating guards. Sensors installed on exterior walls shall be installed on non-conductive (cork) sub-base. Sensors shall have plus or minus local control feature.

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- C. Temperature Sensors: Thermistor type with an accuracy of plus or minus 0.40 degree F over the entire control range. Sensors for pipe installations shall be immersion type, brass well, and thermistor with integral lead wire. Sensors for duct application shall be insertion probe type, stainless steel probe, integral handibox, and thermistor with integral lead wire. Space temperature sensors shall be compatible with the unit controller and shall be provided in a decorative metal or plastic enclosure (Nema 4X where exposed to pool environment). Space temperature sensors shall be provided with setpoint and temperature indication only. Outdoor temperature sensors shall be mounted inside a protective weather and sun shield and shall be located on a North wall.
- D. Humidity Sensors: Thin-film capacitive type sensor with on-board nonvolatile memory, accuracy to plus or minus two percent (2%), 12 - 30 VDC input voltage, analog output (0 - 10 VDC). Operating range shall be 5 to 95% RH and -40 to 170 degree F. Duct mounted type sensors shall have a stainless steel insertion element, sealed to prohibit corrosion. Sensors shall be selected for wall, duct or outdoor type installation as appropriate.
- E. Carbon Dioxide Sensors (CO2): Sensors shall utilize Non-dispersive infrared technology (N.D.I.R.), repeatable to plus or minus 20 PPM. Sensor range shall be 0 - 2000 PPM. Accuracy shall be plus or minus five percent (5%) or 50 PPM, whichever is greater. Response shall be less than one minute. Input voltage shall be 20 to 30 VAC/DC. Output shall be 0 - 10 VDC. Sensor shall be wall or duct mounted type, as appropriate for the application, housed in a high impact plastic enclosure.
- F. Differential Air Pressure Switch: Differential pressure switches for proving fan operation or sense dirty air filters shall be SPDT type, UL approved, and selected for the appropriate operating range of the equipment to which it is applied. Sensor shall have ¼" compression type fittings and shall have an adjustable setpoint. Furnish with ¼" barbed type static pressure tips.
- G. Current Switches (Type 1): For proving fan or pump operational status, provide solid or split-core type current status switches with adjustable setpoint and solid-state internal circuitry. Current switch shall have induced power, trip point set adjustment to plus or minus 1% over a range of 1 to 135 amps, trip and power LED, and field adjustable to indicate both On-Off conditions and loss of load (broken belt, etc.). Units shall have a five-year manufacturer's warranty. Current switches shall be Hawkeye Series H-908 by Veris Industries, or approved equal.
- H. Current Switches (Type 2): For proving fan or pump operational status, provide solid or split-core type current switches ("Go/No" type). Current switch shall have induced power, 100 percent solid state with no moving parts. Units shall have a five-year manufacturer's warranty. Current switches shall be Hawkeye series H-900 by Veris Industries, or approved equal.
- I. Low Temperature Sensors: For sensing low temperatures in air handling units, provide SPST type switch, 35 to 45 degree F range, manual reset, vapor charged twenty foot long sensing element, and 120-volt electrical power connection. Low temperature sensor ("freeze-stat") shall be JCI Model A11A-1, or equal.

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- J. Pressure Transmitters: For sensing static pressure in a duct system (usually for VAV systems), provide a pressure transmitter with integral capacitance type sensing action, solid state circuitry, accuracy of plus or minus 1% of range, zero and span adjustments, 10 to 35 VDC operating voltage, 4 to 20mA output, and integral inlet port connections. Select pressure range suitable for the application. Differential pressure transmitter shall be Ashcroft CXLdp, or approved equal.
- K. Line Voltage Thermostats: For control of equipment using line voltage on-off thermostats (exhaust fans, unit heaters, etc.) provide 120 volt UL Listed wall mounted thermostats. Thermostat shall have a range of 50 to 90 degree F with minimum 2 degree F differential, snap acting switch, and dial adjustment for temperature setting. Line Voltage Thermostats shall be Honeywell series T631 series or approved equal.
- L. Firestat: For sensing sudden increases in duct temperature (ex: fire condition), provide 120 volt UL Listed SPST switch with adjustable setpoint that breaks the circuit on a rise in temperature above the setpoint and de-energizes the air handling unit fan.
- M. Aquastat: For sensing temperature of a fluid within a pipe system, provide 120-volt SPST strap-on type aquastat, temperature control range of 100 to 240 degree F (adjustable). Aquastat shall be JCI Model A19DAC-1, or equal.
- N. Air Flow Monitoring Device
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Ebtron Advantage Gold Series for use with GTx116 transmitters or a comparable product by one of the following:
 - a. Tek-Air Systems
 - b. Johnson Controls
 - 2. Provide airflow/temperature measurement devices (ATMD) where indicated on the plans. Fan inlet measurement devices shall not be substituted for duct or plenum measurement devices indicated on the plans.
 - 3. Each ATMD shall consist of one or more sensor probes and a single, remotely mounted, microprocessor-based transmitter capable of independently processing up to 16 independently wired sensor assemblies.
 - a. Each sensor assembly shall contain two individually wired, hermetically sealed bead-in-glass thermistors.
 - b. Thermistors shall be mounted in the sensor assembly using a marine-grade, waterproof epoxy. Thermistor leads shall be protected and not exposed to the environment.
 - c. The airflow rate of each sensor assembly shall be equally weighted and averaged by the transmitter prior to output.
 - d. The temperature of each sensor assembly shall be velocity weighted and averaged by the transmitter prior to output.

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- e. Each transmitter shall have a 16-character alpha-numeric display capable of displaying airflow, temperature, system status, configuration settings and diagnostics.
- f. Devices using chip-in-glass or diode-case chip thermistors are not acceptable.
- g. Devices using less than two thermistors in each sensor assembly are not acceptable.
- h. Devices using platinum wire RTDs are not acceptable.
- i. Devices having electronic circuitry mounted in or at the sensor probe are not acceptable.
- j. Pitot tubes and arrays are not acceptable.
- k. Vortex shedding devices are not acceptable.

4. All Sensor Probes

- a. Each sensor assembly shall independently determine the airflow rate and temperature at each measurement point.
- b. Each sensor assembly shall be calibrated at a minimum of 16 airflow rates and 3 temperatures to standards that are traceable to the National Institute of Standards and Technology (NIST).
- c. Airflow accuracy shall be $\pm 2\%$ of Reading over the entire operating airflow range.
- i. Devices whose accuracy is the combined accuracy of the transmitter and sensor probes must demonstrate that the total accuracy meets the performance requirements of this specification throughout the measurement range.
- d. Temperature accuracy shall be $\pm 0.15^\circ \text{F}$ over the entire operating temperature range of -20°F to 160°F .
- e. The operating humidity range for each sensor probe shall be 0-99% RH (non-condensing).
- f. Each sensor probe shall have an integral, U.L. listed, plenum rated cable and terminal plug for connection to the remotely mounted transmitter. All terminal plug interconnecting pins shall be gold plated.
- g. Each sensor assembly shall not require matching to the transmitter in the field.
- h. A single manufacturer shall provide both the airflow/temperature measuring probe(s) and transmitter for each measurement location.

5. Duct and Probes

- a. Probes shall be constructed of extruded, gold anodized, 6063 aluminum tube. All wires within the aluminum tube shall be Kynar coated.
- b. Probe assembly mounting brackets shall be constructed of 304 stainless steel. Probe assemblies shall be mounted using one of the following options:
 - i. Insertion mounted through the side or top of the duct

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- ii. Internally mounted inside the duct or plenum
- iii. Standoff mounted inside the plenum

- c. The number of sensor housings provided for each location shall be as follows:

Duct Area (sq.ft.)	Total # Sensors / Location
<2	4
2 to < 4	6
4 to < 8	8
8 to <16	12
>=16	16

- d. The operating airflow range shall be 0 to 5,000 FPM unless otherwise indicated on the plans.

6. Fan Inlet Probes

- a. Sensor assemblies shall be mounted on 304 stainless steel housings.
- b. Mounting rods shall be field adjustable to fit the fan inlet and constructed of nickel plated steel.
- c. Mounting feet shall be constructed of 304 stainless steel.
- d. The operating airflow range shall be 0 to 10,000 FPM unless otherwise indicated on the plans.

7. Transmitters

- a. The transmitter shall have an integral LCD display capable of simultaneously displaying airflow and temperature. The LCD display shall be capable of displaying individual airflow and temperature readings of each independent sensor assembly.
- b. The transmitter shall be capable of field configuration and diagnostics using an on-board pushbutton interface and LCD display.
- c. The transmitter shall have a power switch and operate on 24 VAC (isolation not required).
 - i. The transmitter shall use a switching power supply fused and protected from transients and power surges.
 - ii. The transmitter shall use "watch-dog" circuitry to assure reset after power disruption, transients and brown-outs.
- d. All interconnecting pins, headers and connections on the main circuit board, option cards and cable receptacles shall be gold plated.

- e. The operating temperature range for the transmitter shall be -20° F to 120° F. The transmitter shall be installed at a location that is protected from weather and water.
 - f. The transmitter shall be capable of communicating with other devices using the following interface option: Linear analog output signals for airflow and temperature: Field selectable, fuse protected and isolated, 0-10VDC/4-20mA (4-wire)
- 9. The ATMD shall be UL listed as an entire assembly.
 - 10. The ATMD shall carry the CE Mark for European Union shipments.
 - 11. The manufacturer's authorized representative shall review and approve placement and operating airflow rates for each measurement location indicated on the plans.

2.21 DAMPERS AND ACTUATORS

- A. Damper actuators shall be sized by the Systems Integrator for the intended application. Unless noted otherwise, dampers will be furnished by the Systems Integrator for all field installed dampers that are not included as part of the equipment. In general, provide opposed blade type dampers for modulating control and parallel type dampers for two-position control applications. Actuators shall be equal to Honeywell MS or ML series actuators.
- B. Control Dampers: When indicated to be furnished by the Systems Integrator, control dampers shall be equal to Ruskin CD30VG2 or Honeywell D2 or D3 series dampers. Provide all automatic control dampers not specified to be integral with other equipment. Frames shall be 5 inches wide and of no less than 16-gauge galvanized steel. Inter-blade linkage shall be within the frame and out of the air stream. Blades shall not be over 8 inches wide nor less than 16-gauge galvanized steel triple V type for rigidity. Bearings shall be acetal, oilite, nylon or ball-bearing with ½ inch diameter plated steel shafts. Dampers shall be suitable for temperature ranges of -40 to 180F. All proportional control dampers shall be opposed or parallel blade type as hereinafter specified and all two-position dampers shall be parallel blade types. Dampers shall be sized to meet flow requirements of the application. The sheet metal contractor shall furnish and install baffles to fit the damper to duct size. Baffles shall not exceed 6". Dampers with dimensions of 24 inches and less shall be rated for 3,000 fpm velocity and shall withstand a maximum system pressure of 5.0 in. wc. Dampers with dimensions of 36 inches and less shall be rated for 2,500 fpm velocity and shall withstand a maximum system pressure of 4.0 in. wc. Dampers with dimensions of 48 inches and less shall be rated for 2,000 fpm velocity and shall withstand a maximum system pressure of 2.5 in. wc. Side seals shall be stainless steel of the tight-seal spring type. Dampers shall be minimum leakage type to conserve energy and the temperature control manufacturer shall submit leakage data for all low leakage control dampers with the temperature control submittal. Maximum leakage for low leakage dampers in excess of sixteen inches square shall be 8 CFM per square foot at static pressure of 1 inch of WC. Low leakage damper blade edges shall be fitted with replaceable, snap-on, inflatable seals to limit damper leakage. Testing and ratings shall be in accordance with AMCA Standard 500. Damper blade width shall be no greater than 8 inches, and dampers over 48 inches wide by 74 inches high shall be sectionalized. Testing and ratings to be in accordance with AMCA Standard 500.

- C. Damper Actuators: Damper actuators shall be provided for all automatic dampers. Damper actuators controlled through the DDC system shall be low voltage electronic type, either modulating or two-position, as required to achieve the intended sequence of operation. Provide with spring return when required for fail-safe operation. Modulating dampers shall be positive positioning in response to a 2 - 10 VDC or 4 - 20mA control signal. Actuator shall include the capability of adding auxiliary switches for position indication. Furnish actuators other than spring return type with a release button (clutch) or handle on the actuator to allow for manual override. Power supply to the actuator shall be by 120 VAC, 24 VAC, or 24 VDC and the actuator shall be furnished with a factory installed 3-foot cable with end fitting for field connection. All actuators shall be UL Listed by the manufacturer. Actuators shall be Honeywell MS or ML series actuators.

2.22 VARIABLE FREQUENCY DRIVES.

- A. Variable Frequency drives shall be Honeywell NXS, ABB or equivalent. Variable frequency drives shall be UL listed and sized for the power and loads applied. Drives shall include built-in radio frequency interference (RFI) filters and be constructed to operate in equipment rooms and shall not be susceptible to electromagnetic disturbances typically encountered in such environments. Similarly, the drives must not excessively disturb the environment within which it is used. All VFDs over 3 horsepower shall be provided with an AC choke. VFDs shall be installed in strict conformance to the manufacturer's installation instructions, and shall be rated to operate over a temperature range of 14 to 104 F.
- B. VFD automatic operation shall be provided with a LON, BACNet or Modbus communications card. Each VFD shall be fan cooled and have an integral keypad and alphanumeric display unit for user interface. The display shall indicate VFD status (RUN motor rotation, READY, STOP, ALARM, and FAULT), and shall indicate the VFD current control source (DDC input signal, keypad, or field bus control). In addition to the alphanumeric display, the display unit shall have three pilot lights to annunciate when the power is on (green), when the drive is running (green, blinks when stopping and ramping down), and when the drive was shut down due to a detected fault (red, fault condition presented on the alphanumeric display).
- C. Three types of faults shall be monitored, "FAULT" shall shut the motor down, "FAULT Auto-reset" shall shut the motor down and try to restart it for a programmable number of tries, and "FAULT Trip" shall shut the motor down after a FAULT Auto-reset fails to restart the motor. Coded faults shall be automatically displayed for the following faults:
1. Over current
 2. Over voltage
 3. Earth ground
 4. Emergency stop
 5. System (component failure)
 6. Under voltage
 7. Phase missing
 8. Heat sink under temperature

9. Heat sink over temperature
10. Motor stalled
11. Motor over temperature
12. Motor underload
13. Cooling fan failure
14. Inverter bridge over temperature
15. Analog input control under current
16. Keypad failure
17. Other product unique monitored conditions

- D. In addition to annunciating faults, at the time of fault occurrence the VFD shall capture and make available to the user certain system data for subsequent analysis during fault trouble shooting, including duration of operation (days, hours, minutes, seconds), output frequency, motor current, motor voltage, motor power, motor torque, DC voltage, unit temperature, run status, rotation direction, and any warnings. The last 30 fault occurrences shall be retained as well as the fault data listed in the previous sentence of each fault. New faults beyond 30 shall overwrite the oldest faults.
- E. The display unit keypad shall allow setting operational parameters including minimum and maximum frequency, and acceleration and deceleration times. The display shall offer user monitoring of frequency, unit temperature, motor speed, current, torque, power, voltage, and temperature.

2.23 CONTROL VALVES

- A. Control Valves: (Globe Type) Valves shall be Honeywell or equivalent. Control valves shall be 2-way or 3-way pattern as shown constructed for tight shutoff and shall operate satisfactory against system pressures and differentials. Two-position valves shall be 'line' size. Proportional control valves shall be sized for a maximum pressure drop of 5.0 psi at rated flow (except as may be noted on the drawings). Two-way water valves shall have equal percentage flow characteristics and three-way valves shall have equal percentage flow characteristics straight through and linear through the bypass. Provide valve position indicator on all valves. Leakage rate shall be no more than 0.05% of Cv.
1. Valves 1/2 inch through 1 1/2 inch shall be screwed pattern except where solder connections are specified for valves 1/2 or 3/4 inches. Three-way valves bypass port shall be of one size reduced Cv to preclude the need for a bypass port balancing valve. Valve and cartridge replacement tool shall be configured for maintenance or replacement without draining the coil to prevent water spill; however, an integral isolation valve on the control valve outlet will also be acceptable. Valves shall close off against 58 psi minimum.
 2. Two inch valves shall be "screwed" configuration and 2-1/2 inch and larger valves shall be "flanged" configuration and ANSI-rated to withstand the pressures and temperatures encountered. Valves shall have stainless-steel stems and spring loaded Teflon packaging with replaceable discs.

- B. Control Valves: (Characterized Ball Valves) Valves shall be Honeywell or equivalent. Control valves 1/2 to 2 inches shall be 2-way or 3-way forged brass screwed pattern as shown constructed for tight shutoff and shall operate satisfactory against system pressures and differentials. Two-position valves shall be 'line' size. Proportional control valves shall be sized for a maximum pressure drop of 5.0 psi at rated flow (except as may be noted on the drawings). Two-way water valves shall have equal percentage flow characteristics and three-way valves shall have equal percentage flow characteristics straight through and linear flow through the bypass. Leakage rate shall be ANSI Class IV (no more than 0.01% of Cv). Valves shall be rated for no less than 350 psig at no less than 250 degrees F. Provide a removable handle to operate valves manually during actuator power loss or failure.
- C. Two-way valves shall closeoff against 100 psi minimum, and three-way valves shall closeoff against 40 psi minimum. Valves shall have stainless-steel or chemically nickel-plated brass stem and throttling port. Valves shall be tagged with Cv rating and model number.
- D. Butterfly Control Valves: Valves shall be Honeywell or equivalent. Where specified butterfly control valves over 2" in size shall be cast iron body type for 2-way or 3-way applications specified constructed for tight shutoff and shall operate satisfactory against system pressures and differentials. Valves shall have tapped lugs for standard flange connection, and designed for isolation and removal of downstream piping at full rated pressure. Two-position valves shall be 'line' size. Proportional control valves shall be sized for a maximum pressure drop of 5.0 psi at rated flow (except as may be noted on the drawings). Valves shall be rated for bubble tight shutoff at no less than 150 psi. Valve disc shall be aluminum bronze. Valve stems shall be stainless steel, with inboard top and bottom bronze bearings, and an external corrosion resistant top bearing to absorb actuator side thrust.

2.24 ELECTRICAL MISCELLANEOUS

- A. Panels: All enclosures for DDC controllers and devices shall be fabricated in accordance with UL Standards from code gauge steel. Enclosures shall be provided with a continuous hinge on the door and a flush latching mechanism. Enclosures shall be shop painted with standard grade enamel coating. Back panels shall be furnished when required to facilitate installation of boards or accessories. All enclosures installed outdoors shall be constructed to NEMA 3R standards. All controllers shall be installed within an approved enclosure unless the controller will be installed within the control cabinet section of the equipment that it is intended to control. Enclosures shall facilitate the mounting of gauges, switches, pilot lights, and the like, on the face panel when required. Control devices that are mounted on the face of the panel shall be identified with engraved nameplates. Panels shall be Hoffman A1 series, or approved equal.
- B. Power Transformers: Step-down power transformers shall be provided for all DDC controllers and associated accessory devices as required. Transformers shall be sized and selected to accommodate all connected accessory items. Transformers shall be UL Listed Class 2 type

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with 120 VAC primary, 24 VAC secondary. Transformers shall be Functional Devices TR series, or approved equal.

- C. Relays: Miscellaneous control relays shall be provided as required to energize or control equipment and devices within the control system. Relays shall be located as close as practical to the controlled device (motor, motor starter, etc.). Where approved by NEC, relays may be installed within starters and equipment control panels where space is available. Relays installed outside of the controlled device shall be provided with a NEMA enclosure suitable for the location where installed. Relays shall be Functional Devices RIB series, or approved equal.

2.25 ELECTRICAL WIRING

- A. Wiring: All wiring devices and accessories shall comply with the requirements of Division 26 and the NEC. All wiring shall be installed in a neat and professional manner. Control wiring shall not be installed in power circuit conduits or raceways unless specifically approved for that purpose. All wiring, except plenum wiring (where allowed), shall be run in electrical conduits. Plenum cable will be allowed in concealed locations where accessible. All cable must be installed with 90° angles and strapped according the NEC.
- B. Provide all interlock and control wiring. Provide wiring as required by functions as specified and as recommended by equipment and device manufacturers to achieve the specified control functions.
- C. Low voltage conductors shall be stranded bare or tinned-copper with premium grade polymer alloy insulation. For shielded cable, furnish multi-conductor of overall polyester supported aluminum foil with stranded tinned copper drain wire to facilitate grounding. Coaxial shield shall be copper braided type. Provide shielded cable where recommended by the equipment or device manufacturer, grounded in strict accordance with the manufacture's recommendations.
- D. Magnetic starters and disconnect switches shall not be used as junction boxes. Provide auxiliary junction boxes as required. Terminations for Fire Alarm Control Panel (FACP) interface shall be accomplished by the Electrical Contractor or his designated subcontractor.
- E. FMCS Systems Integrator shall provide power for all control devices and components from the closest available power source or as indicated on the power Drawings. When acceptable to the equipment manufacturer, low voltage power may be obtained from the internal equipment power source or transformer. Electrical Power for Systems Integrator's use has been provided at j-boxes located on plans.
- F. Magnetic starters shall be furnished and installed by the Electrical Contractor.
- G. Disconnects shall be furnished and installed by the Electrical Contractor.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All work described in this section shall be performed by system integrators or contractors that have a successful history in the design and installation of integrated control systems. The installing office shall have a minimum of five years of integration experience and shall provide documentation in the submittal package verifying the company's experience.
- B. Install system and materials in accordance with manufacturer's instructions, and as detailed on the project drawing set.
- C. Drawings of FMCS network are diagrammatic only and any apparatus not shown, but required to make the system operative to the complete satisfaction of the Architect shall be furnished and installed without additional cost.
- D. Line and low voltage electrical connections to control equipment shown specified or shown on the control diagrams shall be furnished and installed by the FMCS Systems Integrator in accordance with the specifications in Divisions 23 and 26.

3.2 WIRING

- A. All electrical control wiring and power wiring to the NAC, computers and network components shall be the responsibility of the FMCS contractor.
- B. All wiring shall be in accordance with the the National Electrical Code and any applicable local codes. All FMCS wiring shall be installed in the conduit unless otherwise allowed by the National Electrical Code or applicable local codes. Where FMCS plenum rated cable wiring is allowed it shall be run parallel to or at right angles to the structure, properly supported and installed in a neat and workmanlike manner.

3.3 WARRANTY

- A. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of system acceptance.
- B. Within this period, upon notice by the Owner, any defects in the work provided under this section due to faulty materials, methods of installation or workmanship shall be promptly (within 48 hours after receipt of notice) repaired or replaced by the FMCS contractor at no expense to the Owner.

3.4 WARRANTY ACCESS

- A. Pending owner pre-approval, the Owner shall grant to the FMCS contractor, reasonable access to the FMCS during the warranty period. The owner shall allow the contractor to access the FMCS from a remote location for the purpose of diagnostics and troubleshooting, via the Internet, during the warranty period.

3.5 SOFTWARE LICENSE

- A. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s). The owner requires that all Niagara Ax based software and hardware on this project have the following Niagara Information Compatibility Statement (NICS):
1. Station Compatibility In = *
 2. Station Compatibility Out = *
 3. Tool Compatibility In = *
 4. Tool Compatibility Out = *

Organizations without the above NICS shall not be allowed to bid.

- B. The owner, or his appointed agent, shall receive ownership of all job specific software configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job specific software code and documentation for all configuration and programming that is generated for a given project and /or configured for use within Niagara Ax based controllers and/or servers and any related LAN / WAN / Intranet and Internet connected routers and devices. Any and all required Ids and passwords for access to any component or software program shall be provided to the owner.

3.6 ACCEPTANCE TESTING

- A. Upon completion of the installation, the FMCS contractor shall load all system software and start-up the system. The FMCS contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to insure that the system is functioning in full accordance with these specifications. The FMCS contractor shall coordinate the checkout of the system such that other appropriate Divisions have a representative present during system checkout.
- B. The FMCS contractor shall perform tests to verify proper performance of components, routines, and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the DDC system operation.
- C. Upon completion of the performance tests described above, repeat these tests, point by point as described in the validation log above in presence of Owner's Representative, as required. Properly schedule these tests so testing is complete at a time directed by the Owner's Representative. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.
- D. System Acceptance: Satisfactory completion is when the Division 230900 contractor has performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner's Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

3.7 OPERATOR INSTRUCTION, TRAINING

- A. During system commissioning and at such time acceptable performance of the FMCS hardware and software has been established, the contractor shall provide on-site operator instruction to the owner's operating personnel. Operator instruction shall be done during normal working hours and shall be performed by a competent representative familiar with the system hardware, software and accessories.
- B. The FMCS contractor shall provide 12 hours of instruction to the owner's designated personnel on the operation of the FMCS and describe its intended use with respect to the programmed functions specified. Operator orientation of the FMCS shall include, but not be limited to; the overall operation program, equipment functions (both individually and as part of the total integrated system), commands, systems generation, advisories, and appropriate operator intervention required in responding to the System's operation.
- C. The training shall be in three sessions as follows:
 - 1. Training: One day session (8 hours) after system is started up and at least one week before first acceptance test. Manual shall have been submitted at least two weeks prior to training so that the owners' personnel can start to familiarize themselves with the system before classroom instruction begins.
 - 2. Warranty Follow Up: Two days (4 hours total) to be scheduled at the request of the owner during the one year warranty period. These sessions shall cover topics as requested by the owner such as; how to add additional points, create and gather data for trends, graphic screen generation or modification of control routines.

END OF SECTION 230900

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SECTION 232000 – PIPE AND PIPE FITTINGS

A. GENERAL

1. This section includes all pipe, pipe fittings, hangers, and supports, etc. as may be required to provide a complete piping system.
2. Testing of all piping shall be made in the presence of the Engineer or a designated representative of the Owner. No piping shall be covered or put into operation before such testing has been approved. Covered pipe shall be exposed at contracts expense. Engineer shall be given 48 hours written notification of test.
3. The actual arrangement of the piping shall follow the general locations shown on the Drawings, such that clearances, line drainage, etc. shall be maintained.
4. Refer to specification Section 2300700 for Pipe Insulation.
5. All piping shall be provided with end caps or have ends covered prior to installation.

B. PRODUCT

1. Refrigerant Piping
 - a) Refrigerant piping shall be Type “L” hard drawn copper.
 - b) Refrigerant piping fittings shall be sweat type wrought copper.
 - c) Use silver solder on all refrigerant piping.
 - d) Copper tubing, which is out of round, will not be acceptable.
 - e) Not notching or mitering of copper tubing will be permitted.
 - f) Do not allow piping to rub against masonry when expanding and contracting.
 - g) Close and protect open ends of piping until final connections are made. Such closing shall be made with fittings, which cannot be easily removed. Caps or plugs shall be made with fittings, which cannot be easily removed. Caps or plugs shall be required at all times during construction so that no pipes are left open at the end of any day’s work, even though continuation is expected the next day.
 - h) Copper pipe ends shall be reamed, sanded and deburred before soldering. Non-corrosive flux shall be used.
 - i) Test refrigerant piping in accordance with the NC Building Code.
2. Make-up Water Piping
 - a) Make-up water piping shall be Type “L” copper with all joints soldered with 95-5 solder.
 - b) Make-up piping shall have dielectric union at connection to ferrous pipe.
3. Condensate Drain Pipe

- a) Drain pan condensate piping shall be Type "L" copper with all joints soldered with 95-5 solder.
- b) Terminate condensate drain lines as shown on drawings. Condensate drains from rooftop units are to be routed to nearest roof drain.

4. Gas Piping

- a) Piping below grade shall be polyethylene having a cell classification of ASTM D-3350-PE234343E. Pipe and pipefittings shall meet the requirements of ASTM D-2513. All fittings and access shall be as manufactured and furnished by the pipe supplier.
- b) Piping above grade shall be standard weight, schedule 40, black steel pipe conforming to ANSI B36.10, ASTM A53, or ASTM 106. Screwed fitting shall be malleable iron, 150 lb. S.W.P, will banded pattern conforming to ANSI B16.3.
- c) Connections between plastic and metallic piping shall be in accordance with the State Code.
- d) All pipes shall be buried in accordance with manufacturer's recommendations.
- e) All plastic pipe shall have a 3" wide detector tape installed 18" above finished grade.
- f) All metal pipe run below grade shall be coated with coal tar enamel coating.
- g) All exposed gas piping surfaces, supports, etc., shall be painted one prime and one finish coat of rust resistant paint. Finish coat shall be yellow according to OSHA Standards unless otherwise noted on the plans.
- h) All gas piping systems shall be tested in strict accordance with the National Fire Protection Association's National Fuel Gas Code NFPA54, and the State Building Code.
- i) All gas piping system shall be air tested at 50 psi for a period of not less than one (1) hour without loss of pressure. Any leaks that occur shall be repaired and another test started. All joints shall be checked for leaks with a water-soap solution. Where leaks are found, the joint shall be re-made.

C. EXECUTION

- 1. Piping 2" and smaller shall be welded or have screwed fittings with extra heavy nipples, unless otherwise noted.
- 2. Piping 2 1/2" and larger shall have welded fittings of the same material and weight as the piping in which they are installed.
- 3. Welding tees or weldolets shall be used.
- 4. No "Stub-In" shall be permitted.
- 5. All insulated piping shall be protected by saddles at horizontal support points or by insulation protectors if the insulation has a vapor barrier. Saddles where used shall be welded to the pipe.
- 6. Sleeves shall be provided wherever pipes pass through walls, floors and ceilings. Sleeves shall be Schedule 40, black steel, 1/2" in diameter larger than the pipe and insulation on the pipe. Sleeves through walls and ceilings shall be flush. Sleeve through floors shall extend two inches above finished floor. Sleeves in exterior walls shall be caulked and made watertight.
- 7. All pipe welding shall be uniform and thorough, and shall comply with AWS standards for pipe weldings. All pipe welding must be done by AWS certified welders experienced in this type of

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work. Provide copy of certification with other credentials to Engineer with piping submittal package.

END OF SECTION 232000

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SECTION 233100 - DUCTWORK

A. GENERAL

1. This Section includes ductwork, splitter dampers, balancing dampers, air deflection devices, etc. required for a complete system.
2. The Drawings are intended to indicate, with reasonable accuracy, the location of components and the general arrangement of the system. All offsets, bends fittings and other devices, not shown but required for the full operation of the system, shall be provided.
3. Refer to specification Section 230700 for duct insulation.

B. PRODUCT

1. Low and Medium Pressure Ductwork.
 - a) Round and rectangular ductwork shall be of gauges and construction methods as indicated in the latest ASHRAE Guide and SMACNA Standard.
 - b) Splitter dampers, balancing dampers, turning vanes and air deflection devices shall be installed as shown on the plans and/or where required for the proper control of airflow.
 - c) All take-offs to diffusers shall be tapered type taps with factory damper and locking quadrant.
 - d) All take-offs to VAV Units shall be made with conical taps.
2. Flexible Ductwork
 - a) Ducts shall be insulated type with foil wrapper complying with NFPA Standard No. 90A and UL181.
 - b) All flexible ducts shall have a factory installed 1" thick 1.5 lb./cu. ft. fiberglass insulation with a seamless vinyl vapor barrier.
 - c) Length of flexible duct shall not exceed 10 feet.
 - d) Flexible duct shall be secured and sealed in place with mastic to hard duct collars at each end, with nylon tie-wraps on the wire enforced inner mylar skin, followed by the insulation layer and then the exterior vapor layer secured with another tie-wrap.
3. Exposed Ductwork
 - a) Exposed shall be round, 18 gauge spiral lock seam with paintable finish, double wall and internally insulated at the factory. Inner wall shall be perforated.
 - b) Duct shall be fastened using sheet metal screws only and no duct tape.
4. Kitchen Hood Ductwork
 - a) Kitchen hood exhaust ductwork shall be welded 16 gauge black steel conforming to NFPA 96.
 - b) This contractor shall supply all necessary welded 16 gauge black steel fittings for transitions to the hood and exhaust fan.
 - c) Ductwork shall be provided with a slope in accordance with the State Building. Cleanouts are to be provided at each change of direction.

- d) Kitchen hood supply ductwork shall be galvanized sheet metal as specified for low-pressure ductwork.
- 5. Dishwasher Hood Ductwork
 - a) Dishwasher hood exhaust ductwork and dishwasher area exhaust ductwork shall be welded seam and joint type 302 stainless steel. All joints shall be welded watertight.
 - b) Ductwork shall be provided with a slope towards the dishwasher intake hood.
- 6. Dryer Ductwork.
 - a) Dryer ductwork shall be round 30 gauge-galvanized steel with substantially airtight joints and shall connect to box outlet.
 - b) Sheet metal screws shall not be used at joint connections.
 - c) Joints shall run in direction of airflow.

C. EXECUTION

- 1. Turning vanes shall be installed in square elbows for all ductwork.
- 2. Duct transitions, splitter dampers, and balancing dampers shall be constructed of gauges and materials as indicated in ASHRAE Guide and SMACNA Standards.
- 3. Hangers and supports for ductwork shall be of metal bands, angles and rods as indicated in ASHRAE Guide and SMACNA Standards. The minimum bandwidth shall be 1", 16 gauge, galvanized steel.
- 4. Where ductwork passes through floors and walls, the space around the ducts shall be sealed in an approved manner with mineral wool insulation, and/or proper fire seal material approved by the State or Local Inspector.
- 5. In exposed areas and mechanical rooms, ductwork openings shall be finished with a metal collar.
- 6. Ductwork shall be cross-braced and reinforced properly with galvanized steel angles as recommended by SMACNA Standards.
- 7. Where ductwork behind grilles or diffusers is visible, it shall be painted with two coats of flat black base fire retardant paint.
- 8. Duct connections to outside air louvers shall be pitched to drain outside and shall be soldered watertight.
- 9. Tape all low-pressure joints with Hardcast or approved equal for completely airtight system.
- 10. All medium pressure joints are to be sealed in accordance with SMACNA standards for ductwork 2" W.C. and greater. All ducts shall be air tight, rigid and free from vibration and noise.
- 11. Duct dimensions shown on the drawings are net inside dimensions.
- 12. Where ductwork is lined, as noted in Section 230700, the duct insulation thickness shall be added to the listed ductwork dimensions for final duct size.

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END OF SECTION 233100

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SECTION 233400 – FANS

A. GENERAL

1. Provide all fans, roof caps, etc., of the type and capacities indicated on the Drawings.
2. Fans, roof caps, curbs, etc., shall be by the same manufacturer.
3. Fans shall be by Greenheck, Loren Cook, Carnes, Penn, American Air Cool, or equal.

B. PRODUCT

1. All fans, roof caps, etc., shall be as scheduled on the Drawings.
2. All fans shall be equipped with 1/2" mesh birdscreen, gravity damper.
3. All fan motors shall have vibration isolators, motor housing shall be grounded, and motor overload protection shall be provided.
4. All curbs shall be of the pre-fab insulated type.
5. Provide NEMA 3R rated disconnect switch.

C. EXECUTION

1. Fans and roof caps shall be installed as shown on the plans.
2. Roof openings and locations are to be coordinated with the other trades.
3. Fan motors and all other electric components shall bear the UL or other acceptable third party testing agency label.

END OF SECTION 233400

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233700 – AIR DISTRIBUTION

A. GENERAL

1. Furnish and install air distribution devices of the type, size and configuration indicated on the drawings.
2. Refer to Architectural Reflected Ceiling Plan and Schedule for types of ceiling specified, and provide compatible frames on air distributions devices.

B. PRODUCT

1. Diffusers, Grilles, and Registers
 - a) Surface mounted devices shall have sponge gaskets.
 - b) Devices shall be of steel construction with baked on enamel finish, unless otherwise noted.
 - c) All devices shall be by Kureger, Carnes, Titus, Metalaire, Tuttle & Bailey, Price or approved equivalent.
 - d) Ceiling mounted diffusers shall have insulation applied to metal top and neck to prevent sweating. Insulation shall match duct insulation.
 - e) Soffit grilles shall be extruded anodized aluminum with ¼" x ¼" insect screen.
 - f) Return and exhaust grilles in lay-in ceilings shall have full louvered face (24" x 24").
 - g) Devices in moist and humid spaces shall be of aluminum construction.
 - h) Provide heavy-duty steel return grilles (in gymnasiums, multi-purpose rooms, etc) or in all locations where the grille is within 8' off the floor.
2. Louvers
 - a) Louvers shall be 12 gauge extruded aluminum with drainable blades, unless otherwise noted.
 - b) Louvers shall be provided with ½" x ½" insect screen.
 - c) Louvers shall be Arrow, Ruskin, Air Balance or approved equivalent.
 - d) Provide louvers with required mounting sleeves/support. Coordinate opening with general contractor.
 - d) Louver indicated on drawings to have motorized damper shall be interconnected with fans indicated, and shall open when the fan is energized. This Contractor shall provide and make all interconnecting control wiring from the fan to the damper.

C. EXECUTION

1. Air distribution devices shall be mounted level, straight, and flush with walls or ceilings.
2. Color shall be as indicated on drawings, or as selected by the Architect/Engineer.
3. Locations of all air distribution devices shall be coordinated with ceiling and lighting work.
4. Provide submittals data to include, cfm, pressure drop, dimensional, velocity and noise criteria data.

END OF SECTION 233700

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SECTION 237000 – SPLIT SYSTEM HEAT PUMP

A. GENERAL

1. Furnish and install a direct expansion heat pump indoor unit with capacity as indicated on the plans.
2. Unit shall be completely factory assembled and pretested.
3. Unit shall be Trane, Lennox, Mitsubishi, or approved equivalent.

B. PRODUCT

1. Air Handling Unit/Fan Coil
 - a. Casing shall be Galvanneal steel, bonderized with baked enamel finish.
 - b. Fan section shall have forward curved blades, centrifugal type, belt or direct drive. Fan shall be statically and dynamically balanced and shall run on permanently lubricated bearings.
 - c. Cooling coils shall be of non-ferrous construction with mechanically bonded aluminum plate fins on copper tube.
 - d. Casing shall be insulated with fire retardant insulation in accordance with NFPA 90A. Insulation shall be secured to casing panels with waterproof cement and permanent fasteners.
 - e. A condensate drain pan shall be furnished with threaded pipe connections and shall extend completely under the coil section. Condensate drain lines shall be insulated copper.
 - f. Electric heater assembly shall include circuit breakers, automatic re-setting limit switches and heat limiter for primary and secondary over-current and thermal protection.
 - g. Accessories shall be as indicated on the drawings.
2. Outdoor Unit
 - a. Cabinet shall be single, enclosed, and weatherproof casing or galvanized steel bonderized and finished with baked enamel. A base pan drain connection shall be provided. Panels shall be easily removable for service access.
 - b. Compressor system shall consist of serviceable hermetic compressor. Compressor shall have service shut-off valves; suction pressure operated capacity control unloader, suitable vibration isolators and crankcase heater.
 - c. Condenser and evaporator coils shall have aluminum plate fins mechanically bonded to copper tubes.
 - d. Outdoor fans shall be propeller type, direct driven. All motors shall have overload protection and suitable vibration isolators.
 - e. Cooling system shall be protected by fusible plug, high and low pressure stat, compressor motor overloads, anti-cycling timer device (5 minutes). Controls shall include low voltage control circuit transformer, compressor and fan motor safety controls

with automatic reset, high and low pressure cutout switches and terminals for accessory electrical connections.

3. EXECUTION

1. Unit shall be installed as shown on the plans, in strict accordance with manufacturer's recommendations.
2. Split System Heat Pumps are to be tested in accordance with UL 1995.
3. Controls shall be as indicated on the plans.
4. Provide 5-year compressor warranty.
5. Provide with spare belts for any belt driven fans.
6. Provide with (2) sets of filters. Contractor to install one set at system start-up and a second set at completion of project
7. Provide owner training for staff designated by staff. Training shall include proper operation and regularly required maintenance.

END OF SECTION 237000

SECTION 260000 - GENERAL PROVISIONS ELECTRICAL

PART 1 - GENERAL

1.1 Scope of Work

- A. This Contractor shall provide all materials, equipment and labor necessary to install and set into operation the electrical equipment as shown on the Engineering Drawings and as contained herein.

1.2 Quality Assurance

- A. See the General and Supplementary General Conditions.
- B. All work shall be in accordance with the North Carolina State Building Code, which includes the 2020 edition of the National Electrical Code.
- C. Wherever the words "Approved", "Approval", and "Approved Equal" appear, it is intended that items other than the model numbers specified shall be subject to the approval of the Engineer.
- D. "Provide" as used herein shall mean that the Contractor responsible shall furnish and install said item or equipment. "Furnish" as used herein shall mean that the Contractor responsible shall acquire and make available said item or equipment and that installation shall be by others. "Install" as used herein shall mean that the Contractor responsible shall make installation of items or equipment furnished by others.
- E. All material and equipment that the Contractor proposes to substitute in lieu of those specified shall be submitted to the Engineer ten (10) days prior to the bid date for evaluation. The submittal shall include a full description of the material or equipment and all pertinent engineering data required to substantiate the equality of the proposed item to that specified.

1.3 Submittals

- A. See General and Supplementary General Conditions and Division 1.
- B. Within ten (10) days after notification of the award of the Contract and written notice to begin work, the Contractor shall submit for approval to the Architect/Engineer a detailed list of equipment and material which he proposes to use. Items requiring submittal data for approval will be noted at this time. Six (6) sets of submittal data shall be provided for approval.
- C. Each submittal shall bear the approval of the Contractor indicating that he has reviewed the data and found it to meet the requirements of the specifications as well as space limitations and other project conditions. The submittals shall be clearly identified showing project name, manufacturer's catalog number and all necessary performance and fabrication data. Detailed submittal data shall be provided when items are to be considered as substitution for specified items. Acceptance for approval shall be in writing from the Engineer.

- D. The Contractor shall submit to the Engineer a set of accurately marked-up plans indicating all changes encountered during the construction. Final payment will be contingent on receipt of these as-built plans.
- E. The Contractor shall furnish an electronic set of maintenance and operating instructions, parts lists, electrical circuit wiring diagrams, all submittal data, and sufficient manufacturer's literature to operate and maintain all equipment.
- F. The Contractor shall submit to the Engineer a duplicate set of final electrical inspection certificates prior to final payment.

1.4 Product Delivery, Storage and Handling

- A. All material and equipment shall be delivered and unloaded by the Contractor within the project site as noted herein or as directed by the Owner.
- B. The Contractor shall protect all material and equipment from breakage, theft or weather damage. No material or equipment shall be stored on the ground.
- C. The material and equipment shall remain the property of the Contractor until the project has been completed and turned over to the Owner.

1.5 Work conditions and Coordination

- A. The Contractor shall review the mechanical plans to establish points of connection and the extent of electrical work to be provided in his Contract.
- B. This Contractor shall be responsible for all electrical work and make final connections to equipment installed in his Contract. Unless otherwise noted, this Contractor shall wire to disconnect switches, junction boxes, or circuit breakers as provided in his Contract.
- C. All work shall be coordinated with other trades. Cutting of new work and subsequent patching shall be approved by Architect/Engineer and shall be at the Contractor's expense with no extra cost to the owner.

1.6 Guarantee

- A. See the General and Supplementary General Conditions.
- B. Where extended warranties or guarantees are available from the manufacturer, the Contractor shall prepare the necessary Contract Documents to validate these warranties as required by the manufacturer and present them to the Owner.

PART 2 - PRODUCT

- 2.1 Materials and equipment shall be new, unless noted otherwise, of the highest grade and quality and free from defects or other imperfections. Materials and equipment found defective shall be removed and replaced at the Contractor's expense.
- 2.2 The Contractor shall provide nameplates for identification of all equipment, switches, panels, transformers, etc. The nameplates for 120/208-volt panels shall be laminated phenolic plastic, blue front and back with white core, white engraved letters (1/2" minimum) etched into the white core. The nameplates for 277/480-volt panels shall be laminated phenolic plastic, black front and back with white core, white engraved letters (1/2" minimum) etched into the white core. Name tags to be mounted with self-tapping sheet metal, stainless steel screws.
- 2.3 All materials and equipment be approved third party labeled or bear re-examination listing where such approval has been established for the type of device in question.

PART 3 - EXECUTION

3.1 Inspection

- A. If any part of this Contractor's work is dependent for its proper execution or for its subsequent efficiency or appearance on the character or conditions of contiguous work not executed by him, the Contractor shall examine and measure such contiguous work and report to the Architect or Engineer in writing any imperfection therein, or conditions that render it unsuitable for the reception of this work. Should the Contractor proceed without making such written report, he shall be held to have accepted such work and the existing conditions and he shall be responsible for any defects in this work consequent thereon and will not be relieved of the obligation of any guarantee because of any such imperfection or condition.
- B. It is the responsibility of the electrical contractor to notify the authority having jurisdiction to schedule required inspections including rough-in, above ceiling and final inspections.

3.2 Installation

- A. All work shall be performed in a manner indicating proficiency in the trade.
- B. All conduit, pipes, ducts, etc., shall be either parallel to building walls or plumb where installed in a vertical position and shall be concealed when located in architecturally finished areas.
- C. Any cutting or patching required for installation of this Contractor's work shall be kept to a minimum. Written approval shall be required by the Architect/Engineer if cutting of primary structure is involved.
- D. All patching shall be done in such a manner as to restore the areas or surfaces as to match existing finishes.
- E. The Contractor shall lay out and install his work in advance of pouring concrete floors or walls. He shall furnish and install all sleeves or openings through poured masonry floors or walls above grade required for passage of all conduits, pipes or duct installed by him. The Contractor shall furnish and install all inserts and hangers required to support his equipment.

3.3 Grounding

- A. All grounding shall be in accordance with the requirements of the NEC.
- B. Install a separate green grounding conductor with the circuit conductors in each conduit. Use of the conduit only shall not be an acceptable means of equipment grounding.
- C. All grounding conductors shall be sized per Article 250.122 of the NEC.
- D. The ground system shall be tested with an "Earth Megger" and the test report submitted to the Engineer. If resistance exceeds 25 ohms provide an additional driven ground rods separated by a minimum of 6' interconnected with #3/0 copper. A copy of the test report shall be submitted to the electrical engineer.
- E. All ground points shall be accessible for inspection.
- F. Boxes with concentric, eccentric or over-sized knockouts shall be provided with bonding bushings and jumpers. The jumper shall be sized per NEC Table 250.122 and lugged to the box.

3.4 Electrical Identification

- A. Furnish and install engraved laminated phenolic nameplates for all safety switches, panel boards, transformers, switchboards, motor control centers and other electrical equipment supplied for the project for identification. Nameplates shall be securely attached to equipment with self-tapping stainless-steel screws; if the screw sharp end is protected; otherwise Rivets shall be used. Letters shall be approximately 1/2-inch-high minimum. Embossed, self-adhesive plastic tape is not acceptable for marking equipment. Nameplate material colors shall be:
 - 1. Blue surface with white core for 120/208-volt equipment.
 - 2. Black surface with white core for 277/480-volt equipment.
 - 3. Bright red surface with white core for all equipment related to fire alarm system.
 - 4. Dark red (burgundy) surface with white core for all equipment related to security.
 - 5. Green surface with white core for all equipment related to "emergency" systems.
 - 6. Orange surface with white core for all equipment related to telephone systems.
 - 7. Brown surface with white core for all equipment related to data systems.
 - 8. White surface with black core for all equipment related to paging systems.
 - 9. Purple surface with white core for all equipment related to TV systems.
- B. Furnish and install self-adhesive plastic tape for all receptacle and wall switch cover plates indicating circuit numbers.

- C. Furnish and install self-adhesive embossed plastic labels on outside of all junction box cover plates indicating circuit numbers.
- D. All empty conduit runs and conduit with conductors for future use shall be identified for use and shall indicate where they terminate. Identification shall be by tags with string or wire attached to conduit or outlet.

3.5 Performance

- A. The Contractor shall perform all excavation, backfilling, and patching operations as indicated on the drawings.

3.6 Erection

- A. All support steel, angles, channels, pipes or structural steel stands and anchoring devices that may be required to rigidly support or anchor material and equipment shall be provided by this Contractor.

3.7 Field Quality Control

- A. The Contractor shall conform to the requirements of Division 3 for concrete testing.
- B. The Contractor shall test his entire installation and shall furnish the labor and materials required for these tests. Tests shall be performed in accordance with the requirements of the section of the specifications and in accordance with the requirements of the State Ordinances and Codes, and the National Electrical Code. The Contractor shall notify the Engineer of his readiness for such test. Final inspections are required along with final inspection certificates are required, prior to authorization of final payment.
- C. Testing required for compliance with the Contract shall be stated in subsequent sections. All tests specified shall be completely documented indicating time of day, date, temperature and all pertinent test information. All required documentation of readings indicated above shall be submitted to the engineer prior to, and as one of the prerequisites for, final acceptance of the project.
- D. Documentation
 - 1. All tests specified shall be completely documented indicating time of day, date, temperature and all pertinent test information.
 - 2. All required documentation of readings indicated above shall be submitted to the engineer prior to, and as one of the prerequisites for, final acceptance of the project.

3.8 Adjust and Clean

- A. All equipment and installed materials shall be thoroughly clean and free of all dirt, oil, grit, grease, etc.

- B. Factory painted equipment shall not be repainted unless damaged areas exist. These areas shall be touched up with a material suitable for the intended service. In no event shall nameplates be painted.
- C. At a scheduled meeting, the Contractor shall instruct the Owner or the Owner's representative in the operation and maintenance of all equipment installed under his Contract (in the presence of the Engineer).

END OF SECTION 260000

SECTION 260520 - WIRES AND CABLES

PART 1 - GENERAL

- 1.1 All conductors shall be properly marked showing manufacturer's name, insulation type, voltage rating and wire size. All insulation is to be rated for minimum of 600 volts.
- 1.2 Wire sizes shall be as shown. No wire smaller than No. 12 AWG shall be used. The maximum conductor size shall be 500 KCMIL.
- 1.3 Where the conductor length from the panel to the first outlet on a 120 volt exceeds 50 feet, the branch circuit conductors from the panel to the first outlet shall be increased by at least one size. Refer to the wire size chart on the drawings. Per NEC 250.122(B), equipment grounding conductors, where installed shall be increased in size proportionately according to the circular mil area of the ungrounded conductors.
- 1.4 Conductors shall be manufactured by US Wire and Cable, Triangle, Okonite, Southwire, or approved equivalent.
- 1.5 Wiring for 120/208-volt systems and 277/480-volt systems shall not be mixed in the same race way, pull or junction box.

PART 2 - PRODUCT

- 2.1 All conductors shall be copper and shall conform to Underwriters' Standards. Wires No. 10 and smaller shall be solid. Wires 8 and larger shall be stranded.
- 2.2 All wire shall be labeled two (2) feet on centers giving size, type voltage, rating, and manufacturer's name. Wire #6 and smaller #6 shall be factory color coded. Wire larger than #6 may be color coded with approved 2000-volt colored tape at all terminals of the run, and at all junctions.
- 2.3 Where applicable, all wire shall be color coded as follows, or approved by the Engineer:

A. 120/208-volt system:

Phase A	Black
Phase B	Red
Phase C	Blue
Neutral	White
Ground	Green

B. 277/480-volt system:

Phase A	Brown
Phase B	Orange
Phase C	Yellow
Neutral	Natural Gray
Ground	Green

- 2.4 Insulation type shall be UL labeled for the appropriate type of use and temperature. Insulation types are as follows:

- A. The insulation type for interior wiring shall be dual-rated THHN/THWN or XHHW.
- B. The insulation type for wiring in exterior wet locations shall be THWN-2 or XHHW-2.

PART 3 - EXECUTION

- 3.1 Conductors shall be run in conduit and shall be continuous from outlet to outlet. Splices will not be made except within accessible outlet or junction boxes, troughs, or gutters.
- 3.2 Solid conductors shall be spliced by using Ideal "wing- nuts", 3M Company's "Scotchlok" connectors for branch circuit splices. Crimp connectors will not be allowed for branch circuit splicing.
- 3.3 Joints in stranded conductors shall be spliced by approved mechanical connectors and gum rubber tape or friction tape. Solderless mechanical connectors for splices and taps, provided with U/L-approved insulating covers, may be used instead of mechanical connectors plus tape.
- 3.4 On mechanical splices, taps or joints taping shall be with at least two (2) layers of approved gum rubber tape which will be laid on the half-lap followed by at least one (1) layer of friction or plastic tape laid on with half-lap. It is intended that all taping shall be a permanently secured insulation equal to that of the wire.
- 3.5 All conductors in any conduit shall be at one specific voltage. Conductors of different voltages shall be run in separate conduits.
- 3.6 Neutral conductors shall be properly installed as to prevent grounding of the neutrals in any conduit. Multi-wire circuits with shared neutral conductors are not allowed. Each single pole load shall have individual neutral for each circuit.
- 3.7 Neatly train and lace wiring inside boxes, equipment, and panelboards.
- 3.8 Make conductor lengths for parallel circuits equal.
- 3.9 Pull all conductors into a raceway at the same time. Use third party approved wire pulling lubricant for pulling #4 AWG and larger wires.
- 3.10 Insulation Resistance Testing.
All current carrying phase conductors and neutrals shall be tested as installed, and before connections are made, for insulation resistance and accidental grounds. This shall be done with a 500-volt megger. The procedures listed below shall be followed:
 - A. Minimum readings shall be one million (1,000,000) or more ohms for #6 AWG wire and smaller, 250,000 ohms or more for #4 AWG wire or larger, between conductors and between conductor and the grounding conductor.
 - B. After all fixtures, devices and equipment are installed and all connections completed to each panel, the contractor shall disconnect the neutral feeder conductor from the neutral bar and take a megger reading between the neutral bar and the grounded enclosure. If this reading is less than 250,000 ohms, the contractor shall disconnect the branch circuit neutral wires from

this neutral bar. He shall then test each one separately to the panel and until the low readings are found. The contractor shall correct troubles, reconnect and retest until at least 250,000 ohms from the neutral bar to the grounded panel can be achieved with only the neutral feeder disconnected.

- C. The contractor shall send a letter to the engineer certifying that the above has been done and tabulating the megger readings for each panel. This shall be done at least four (4) days prior to the final inspection.

3.11 Use of split bolt connectors is not acceptable.

3.12 Prior to energizing, feeders and service conductor cables shall be tested for electrical continuity and short circuits. A copy of these tests should be sent to the engineer of record and the owner.

END OF SECTION 260520

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SECTION 260533 BOXES AND CABINETS

PART 1 - GENERAL

- 1.1 The Electrical Contractor shall provide junction boxes, pull boxes, cable, support boxes, and wiring troughs as required by NEC and as otherwise indicated in the Drawings.
- 1.2 All necessary mounting hardware and accessories shall be provided for a complete installation.

PART 2 - PRODUCT

- 2.1 Outlet and junction boxes shall be 4" minimum size, octagonal in ceilings, 4" square or rectangular (4" x 4" minimum for walls) except as noted below. Ceiling outlet boxes shall not be less than 1 1/2" deep, but in no case shall the size and depth of boxes be less than the required by the NEC.
- 2.2 Outlet boxes shall be equipped with plaster rings of appropriate depth to finish flush with finished walls. Outlets in exposed masonry wall shall be equipped with extra deep square corner tile rings so that box may be installed in the core of the block.
- 2.3 Outlets for concealed work and ceiling outlets for exposed work shall be galvanized stamped steel. Boxes shall be as manufactured by ABB-Steel City, Hubbell-RACO, Appleton or equivalent.
- 2.4 Wall outlets for exposed conduit work shall be Crouse-Hinds, Appleton, Hubbell-Killark or equal, series FS and FD switch and receptacle threaded hub boxes, with matching FS and FD covers.
- 2.5 Junction boxes for change of direction or feeder taps shall be furnished where required, shall be of adequate size to prevent crowding conductors in accordance with the requirements of the electrical code and job requirements and shall be accessible.
- 2.6 Junction boxes on finished wall and ceilings shall be flush with covers.
- 2.7 Junction boxes larger than 5" square shall be galvanized and without pre-formed knockouts.

PART 3 - EXECUTION

- 3.1 Boxes and troughs shall be supported independently of conduit entering them. Brackets, threaded rod hangers with lock nuts, bolts, or other suitable supporting methods may be used.
- 3.2 Thru-the-wall outlet boxes shall not be permitted. Outlet boxes shown back to back on plans, shall be separate boxes connected where required using a loop of flexible metallic conduit with ground wire. Boxes shall be separated a minimum of 18 inches apart.
- 3.3 In general, outlets shall be installed at the heights indicated on the fixture and symbol legend.
- 3.4 Each outlet designated on the plans shall be provided with an outlet box.

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- 3.5 Each outlet box which supports a fixture shall be provided with a fixture stud into the outlet box. Outlet box and/or fixture stud shall be attached with not less than three screws or bolts.
- 3.6 Exterior outlets shall be provided with watertight gaskets and covers.

END OF SECTION 260533

SECTION 260545 - CONDUIT AND CONDUIT FITTINGS

PART 1 - GENERAL

- 1.1 Conduit shall be delivered to the project site in bundles of full-length pipes, each length marked with the trademark of the manufacturer and the Underwriters' Laboratories, Inc. stamp. Each conduit length shall be straight, true and free from scales, blisters, burrs and other imperfections.
- 1.2 Within the building parameters and above the floor slab, the rigid steel conduit specified shall be used unless specifically noted otherwise.
- 1.3 Conduit size for control wiring shall be a minimum of one-half (1/2) inch conduit. All branch circuit conduit shall be a minimum of one-half (1/2) inch. Percent filled and derating shall be in accordance with the National Electrical Code. Flexible metal and water-tite ("sealtite") conduit in size 1/2" and larger shall be acceptable for motor, appliance, and fixture connections from fixture junction boxes or appliance/motor disconnects provided a ground wire is installed in the flex and the flex assembly is an integral part of the fixture, shipped from the same factory as the fixture, and 3rd party agency approved for such use. This same requirement shall apply for motor/appliance connections.
- 1.4 All conduit shall be installed in accordance with the National Electrical Code.
- 1.5 Metallic conduits shall be manufactured by Allied, Wheatland, Cruse-Hinds, or equivalents.
- 1.6 Non-metallic conduits shall be manufactured by Prime Conduit, Cantex, Champion Fiberglass or equivalents.
- 1.7 Conduit fittings shall be manufactured by Rayco, T & B, Crouse Hinds, O-Z/Gedney or equivalents.
- 1.8 Surface mounted raceway shall be used as noted on the plans in lieu of exposed conduit. Surface mounted raceway shall be manufactured by Wiremold or approved equivalents.

PART 2 - PRODUCT

- 2.1 Thin Wall Conduit and Fittings
 - A. Electrical metallic tubing (EMT) shall be cold-rolled steel tubing with zinc coating on the outside and protected on the inside by a zinc, enamel or equivalent corrosion-resistant coating conforming to the latest requirements of ANSI. Conduit shall meet the Rigid Conduit Association Standards.
 - B. Electrical metallic tubing fittings shall be all steel plated hexagonal threaded compression type. No pot metal, indenter, or set screw fittings, shall be used. EMT connectors shall have insulated throats.
- 2.2 Rigid Steel Conduit and Fittings
 - A. Rigid steel conduit, including elbows and nipples, shall be standard weight, mild steel pipe, hot dipped galvanized, sherardized or zinc-coated conforming to the requirements of ANSI

C80.1, 1966 or later edition. Rigid steel conduit shall also meet the latest requirements of Underwriters' Laboratories, Inc. Standards for Rigid Metallic Conduit.

- B. Fittings shall be all steel plated hexagonal threaded fitting.

2.3 Flexible Metal Conduit and Fittings

- A. Flexible metal conduit shall be of the best grade interlocking spiral strip steel. The interlocking spiral strip construction shall be such as to permit bending of the conduit to a radius of four (4) times its internal diameter without distorting at any point. The interior and the exterior of the flexible conduit shall be smooth and free of burrs, sharp edges, or other defects which could damage the wire.
- B. Fittings shall be of the approved types, made of malleable iron and hot dipped galvanized.
- C. All connectors shall be steel compression fittings with insulated throats.
- D. Where watertight flexible conduit is required, it shall have an outer sheath of material similar to PVC.

2.4 Non-metallic Conduit

- A. Non-metallic conduit shall be UL listed, for its application. It shall be resistant to sunlight and chemical and moisture atmospheres and rated for use with 90 degrees Celsius conductors.
- B. The installation and usage of rigid non-metallic conduit shall comply with Article 352 of the National Electrical Code, along with any related or referenced sections.

PART 3 - EXECUTION

3.1 General

- A. All conduit shall be run tight against walls, columns or ceilings.
- B. The conduit shall bend cold 90 degrees about a radius equal to ten (10) times its own diameter without signs of flaw or fracture in either pipe or protective coverings. All bends and offsets shall be made on a forming tool to prevent the conduit or its coating from being damaged in the bending. Conduit bends shall have a radius not less than ten (10) times the conduit diameter.
- C. Where conduits join any couplings or threaded fittings, the ends shall be made watertight. (All conduit runs, including boxes, couplings, and fittings used therein, shall be so installed and equipped as to prevent water from entering the conduit.)
- D. All conduits shall be carefully cleaned before and after erection. After cleaning, all ends of conduits shall be free from burrs and inside surfaces shall be free from imperfections likely to injure the wires or cables.
- E. In every instance, conduit shall be installed in such a manner that the conductors may readily and easily be drawn or pulled in without strain or damage to the insulation; and, also, so that defective conductors may be readily and easily withdrawn and replaced by new conductors.

Long radius bends and a sufficient number of approved pull and junction boxes shall be approved for this purpose, and as may be directed by the Engineer. All conduit shall be securely supported and grounded.

- F. In unfinished areas, exposed conduit shall be run to conform to the building lines with special emphasis on neatness. Turns shall be made with galvanized outlet boxes, junction boxes, factory fittings and/or symmetrical bends. Locknuts and bushings shall be employed to provide full grounding and adequate protection of insulation. Double locknuts shall be used on all conduits entering sheet metal enclosures.
- G. Support for all conduit shall be in accordance with the National Electrical Code. Conduit shall be supported by approved pipe straps or clamps, secured by means of toggle bolts on hollow masonry, expansion shields and matching screws or standard pre-set inserts on concrete or solid masonry, machine screws or bolts on metal surfaces, and wood screws on wood construction.
- H. All empty conduit systems shall be capped or terminated in a junction box and shall be provided with nylon pull cord inside for future use.
- I. Conduit terminating below grade shall be provided with means to prevent entry of dirt or moisture. Depth of burial shall not be less than two (2) feet below grade. All termination points shall be accurately marked and dimensioned on the As-Built Plans.
- J. Where conduits of any type pass over a building expansion joint, a standard "expansion joint fitting" compatible with the type of raceway shall be provided.
- K. Conduits installed on the interior of exterior building walls shall be spaced off the surface a minimum of 1/4" using "clamp-backs" or strut.

3.2 Thin Wall Conduit and Fittings

- A. Except for service and feeder conduits, electrical metallic tubing and fittings may be installed in lieu of rigid conduit in dry construction in furred spaces, ceiling cavities, chase spaces, interior portions other than concrete and solid plaster, or for exposed work except on mechanical structure or supports.
- B. Electrical metallic tubing shall not be installed.
 - 1. Where exposed to severe corrosive conditions and/or severe physical damage,
 - 2. Nearer than four (4) feet from finished floor in exposed areas
 - 3. In trade sizes larger than two (2) inches
 - 4. Located in exterior walls or in poured concrete.
 - 5. Any location outdoors.
 - 6. Where tubing, coupling, elbows and fittings would be in direct contact with the earth or underground (in/below slab-on-grade or in earth).

7. A transition between a run of rigid conduit concealed in a wall and a run of thin wall conduit along a ceiling shall be made in an outlet box above the ceiling, if accessible, near the wall.

3.3 Rigid Steel Conduit and Fittings

- A. All conduit terminations shall be provided with insulating bushings.
- B. Condulet fittings shall not be used in lieu of pull boxes.
- C. Except where located under the ground floor slab, all service and feeder conduit shall be heavy wall (rigid galvanized).
- D. Rigid steel conduit shall be installed in exterior masonry walls, in wet locations where subject to severe physical damage, or where conduit trade size is two and one half (2 1/2) inches or larger.

3.4 Flexible Metal Conduit and Fittings

- A. Flexible metallic conduit shall be provided at the end of each conduit run terminating at the conduit box on electric motors, transformers or other equipment.
- B. The length of flexible conduit shall be in accordance with the National Electric Code.

3.5 Non-Metallic Conduit

- A. Thin wall rigid non-metallic conduit (schedule 40 PVC) shall only be used for concrete encasement.
- B. Except where embedded in concrete, conduit shall be supported to permit adequate lineal movement to allow for expansion and contraction of conduit due to temperature change. Where a temperature change in excess of 14 degrees Celsius is anticipated, such as direct burial, exposed outside of the building, or in un-insulated spaces inside the building (attics, crawl spaces, etc.), expansion joints shall be installed in accordance with the manufacturer's specifications.
- C. Heavy wall non-metallic conduit (schedule 80 PVC) shall be used where conduits are direct buried exterior to the building or exposed exterior to the building.
- D. PVC schedule 40 shall not be used exposed or concealed in gypsum wall but may be used in CMU walls. PVC schedule 40 may be used in elevated floor slabs and in foundation slabs. Minimum concrete cover shall be 3/4 inch at finished or formed surface and shall be 3 inches at concrete surface cast against earth or for slabs placed on-grade. Greater amounts of concrete cover shall be used in areas subject to damage. The placement of conduit in floor slabs must be thoroughly coordinated with the structural design. Potential conflicts with steel reinforcing bars and reductions in net concrete sections are among the issues that must be considered by the structural engineer.

3.6 Underground Raceways

- A. Where conduit is installed under the ground floor slab within the building foundations, schedule 40 PVC conduit shall be used. At the Contractor's option, this installation may consist of galvanized steel conduit encased with three (3) inches of concrete or rigid steel conduit with a minimum of 15 mils of PVC coating. Where thin wall non-metallic conduit is used under the ground floor slab, the elbows and turn out required to turn the raceway up into cabinets, equipment, boxes, etc. shall be of rigid steel.
- B. Branch circuit raceways run underground external to building foundation walls shall be run in raceways installed in accordance with the NEC and shall be of a type approved by the NEC as "suitable for direct burial." Minimum raceway size shall be 1 inch.
- C. All underground raceways shall be identified by underground line marking tape located directly above the raceway at 6 to 8 inches below finished grade. Tape shall be permanent, bright-colored, continuous printed, plastic tape compounded for direct burial not less than 6 inches wide and 4 mils thick. Printed legend shall be indicative of general type of underground line below.
- D. Raceways run underground internal to building foundation walls shall be of a type and installed by a method approved by the NEC.
- E. Where underground raceways are required to turn up into cabinets, equipment, etc., and on to poles, the elbow required and the stub-up out of the slab or earth shall be of rigid steel.
- F. The raceway system shall not be relied on for grounding continuity.
- G. Where passing through a "below grade" wall from a conditioned interior building space, raceways shall be sealed utilizing fittings similar and equal to OZ/GEDNEY type "FSK" thru-wall fitting with "FSKA" membrane clamp adapter if required.

END OF SECTION 260545

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SECTION 262416 - PANEL BOARDS AND CIRCUIT BREAKERS

PART 1 - GENERAL

- 1.1 The Electrical Contractor shall provide all panelboards and circuit breakers as shown on the plans in accordance with this specification.
- 1.2 All equipment shall meet UL, NEC and NEMA Standards as applicable to the equipment specified herein.
- 1.3 All panelboards shall be equipped with a main circuit breaker or main lugs as indicated on the drawings.
- 1.4 All panelboards shall be equipped with branch breakers as shown on the drawings.
- 1.5 All panelboards identified on the drawings for use as service equipment shall be so labeled and UL listed for such use.
- 1.6 Full size insulated copper neutral bars shall be included in all panelboards. Neutral busing shall have a suitable lug for each outgoing feeder requiring a neutral connection.
- 1.7 A copper ground bus shall be included in all panelboards.
- 1.8 All current-carrying parts of the bus assembly shall be copper with tin plating.
- 1.9 Panelboards shall be labeled with a UL short circuit rating not less than the rating indicated on the drawings.
- 1.10 The word "spare", unless noted otherwise on the panel schedules, shall be a single pole, 20-amp circuit breaker.
- 1.11 The word "space", unless noted otherwise on the panel schedules, shall be for a space in the panelboard for a standard size, single pole circuit breaker.
- 1.12 Terminals for feeder conductors to the panelboard mains and neutral shall be UL listed as suitable for the type of conductor specified. Terminals for branch circuit wiring, both breaker and neutral, shall be UL listed as suitable for the type of conductor specified.
- 1.13 Sub fed breakers are not acceptable.
- 1.14 Series rated panel boards or breakers are not acceptable.
- 1.15 All NEMA 1 panel boards shall have a hinged trim (Door in Door).
- 1.16 All panelboards shall have breakers, terminals, and Lugs UL approved use with 75°C rated conductors.

PART 2 - PRODUCT

2.1 This section shall be for panelboards whose characteristics shall not exceed the following:

Voltage	=	240	Maximum Branch Circuit	=	100 amps
Amps	=	600	Short Riding Circuit	=	22,000 amps

- A. Panelboards shall be Square D Company type NQ (bolt- on) or equivalent by Siemens, Eaton, or ABB.
- B. Bus bar connections to the branch circuit breakers shall be the "distributed phase" or "phase sequence" type.
- C. The panelboard bus assembly shall be enclosed in a steel cabinet. The size of the wiring gutters and gauge of steel shall be in accordance with NEMA, UL and National Electrical Code requirements for panelboards. The box shall be fabricated from galvanized steel or equivalent rust-resistant steel. Surface mounted cans shall be galvanized and without preformed knockouts.
- D. Fronts shall include doors and have flush, brushed stainless steel, cylinder tumbler-type locks with catches and spring-loaded door pulls. The flush lock shall not protrude beyond the front of the door. All panelboard locks shall be keyed alike. Door shall be mounted by completely concealed steel hinges. A circuit directory frame with a clear plastic covering and a directory card shall be provided on the inside of the door. Fronts shall be of code gauge, full finished steel with rust-inhibiting primer and baked enamel finish.
- E. Panelboard trims shall cover all live parts. Switching device handles shall be accessible.

2.2 This section shall be for panelboards whose characteristics shall not exceed the following:

Voltage	=	480	Maximum Branch Circuit	=	125 amps
Amps	=	600	Short Circuit Rating	=	65,000 amps 480 VAC
				=	100,000 amps 240 VAC

- A. Panelboards shall be Square D Company Type NF (bolt- on) or equivalent by Siemens, Eaton, or ABB.
- B. Bus bar connections to the branch circuit breakers shall be the "distributed phase" or "phase sequence" type.
- C. The panelboard bus assembly shall be enclosed in a steel cabinet. The size of the wiring gutters and gauge of steel shall be in accordance with NEMA, UL and National Electrical Code requirements for panelboards. The box shall be fabricated from galvanized steel or equivalent rust-resistant steel. Surface mounted cans shall be galvanized and without preformed knockouts.
- D. Fronts shall include doors and have flush, brushed stainless steel, cylinder tumbler-type locks with catches and spring-loaded door pulls. The flush lock shall not protrude beyond the front of the door. All panelboard locks shall be keyed alike. Door shall be mounted by completely concealed steel hinges. A circuit directory frame with a clear plastic covering and a directory

card shall be provided on the inside of the door. Fronts shall be of code gauge, full finished steel with rust-inhibiting primer and baked enamel finish.

- E. Panelboard trims shall cover all live parts. Switching device handles shall be accessible

2.3 This section shall be for panelboards whose characteristics shall not exceed the following:

Voltage	=	480	Maximum Branch Circuit	=	1,200 amps
Amps	=	1,200	Short Riding Circuit	=	200,000 amps

- A. Panelboards shall be Square D Company, Type I-Line or equivalent by Siemens, Eaton, or ABB
- B. Panelboard assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel are to be as specified in UL Standard 50 for cabinets. The size of wiring gutters shall be in accordance with NEMA, UL and NEC Standards for panelboards. Cabinets are to be equipped with spring latch and tumbler-lock on door of trim. Doors over 48" long shall be equipped with three-point latch and vault lock. All locks shall be keyed alike. End walls shall be removable. Fronts shall be of code gauge, full finished steel with rust inhibiting primer and baked enamel finish.
- C. The panelboard interior assembly shall be dead front with panelboard front removed. Main lugs or main breaker shall be barriered on five sides. The barrier in front of the main lugs shall be hinged to a fixed part of the interior. The end of the bus structure opposite the mains shall be barriered.
- D. A circuit directory frame with a clear plastic covering and a directory card shall be provided on the inside of the door.

2.4 Molded Case Circuit Breakers

- A. This specification covers molded case circuit breakers rated 15 through 1200 amperes 120VAC, 240VAC, 277VAC and 480VAC. Breakers covered under this specification may be installed in switchboards, panelboards, motor control centers, combination motor starters, busway plugs and individual enclosures.
- B. Circuit breakers shall be manufactured by Square D Company of the size as indicated on the drawings or equivalent by Siemens, Eaton or ABB. All breakers shall be bolt-on type.
- C. All circuit breakers shall have a quick-make, quick-break over center toggle type mechanism. The handle mechanism shall be trip-free to prevent holding contacts closed against a short circuit or sustained overload. All circuit breakers shall assume a position between on and off when tripped automatically. Multi-pole circuit breakers shall be common trip such that an overload or short circuit on any one pole will result in all poles opening simultaneously. Arc extinction is to be accomplished by magnetic arc chutes. All ratings shall be clearly visible.
- D. Automatic operation of all circuit breakers shall be obtained by means of thermal-magnetic tripping devices located in each pole providing inverse time delay and instantaneous circuit protection. Circuit breakers shall be calibrated to carry 100% rated current in an ambient of 40 degrees Celsius. Circuit breakers shall be ambient compensating in that, as the ambient

temperature increases over 40 degrees Celsius, the circuit breaker automatically derates itself to better protect its associated conductor. The instantaneous magnetic trip shall be adjustable and accessible from the front of all circuit breakers on frame sizes 250 amps and above.

- E. The interrupting rating of each circuit breaker shall be as indicated on the drawings. The interrupting rating of the circuit breakers shall be at least equal to the available short circuit current at the line terminals of the circuit breaker and correspond to UL listed integrated short circuit current rating specified for the panelboards and switchboards.
- F. UL Class A (5 milliamperes sensitivity) ground fault circuit protection shall be provided on 120 V ac branch circuits as specified on the plans or panelboard schedule. This protection shall be an integral part of the branch circuit breaker which also provides overload and short circuit protection for branch circuit wiring. Tripping of a branch circuit containing ground fault circuit interruption shall not disturb the feeder circuit to the panelboard. A single pole circuit breaker with integral ground fault circuit interruption shall require no more panelboard branch circuit space than a conventional single pole circuit breaker.
- G. Motor starters, and other applications as indicated on drawings, shall be furnished with magnetic-only type molded case circuit breakers. Each breaker shall be provided with a single magnetic adjustment that will set all poles to the same trip current. Adjustment shall be continuous throughout the adjustable trip range. The magnetic trips shall be accessible from the front of these circuit breakers.

PART 3 - EXECUTION

- 3.1 Panelboards shall be flush, or surface mounted as shown on the plans.
- 3.2 Panel enclosures shall not be used as junction or pull boxes for splicing conductors.
- 3.3 Each flush mounted panel shall be equipped with two empty one inch conduits sealed in the wall from a panel to a six inch square flush mounted box installed above a lay-in type ceiling or flush in the wall at the ceiling for a plaster or spline type acoustical tile ceiling.
- 3.4 All panels shall be equipped with neatly typed directory cards attached on the inside of the door.
- 3.5 GFI circuits shall be tested by the Contractor prior to the pre-final inspection.
- 3.6 Testing shall be performed by a qualified factory technician at the job site. All readings shall be tabulated by the contractor.
- 3.7 The number of branch circuit shall be identified with permanent wire tag attached to the wire.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

- 1.1 Switches, dimmer switches, photocell, contactors and receptacles, with proper cover plates, shall be provided where indicated on the Drawings.

PART 2 - PRODUCT

- 2.1 Switches, dimmer switches, photocell, contactors and receptacles shall be as specified in the Symbol Schedule of the Drawings.
- 2.2 All switches and receptacles shall be industrial specification grade or heavy-duty grade meeting NEMA WD 1, NEMA WD 6, DSCC W-C-596G, and UL-498 and shall be approved third-party listed.
- 2.3 Switches and receptacles shall be as manufactured by Hubbell, Pass and Seymour, Leviton or Eaton. Photocells shall be manufactured by Tork, Paragon, Bryant, or equivalent.
- 2.4 Cover plates for all wall mounted devices shall be provided as scheduled on the Drawings. Where covers are not specified, they shall be as follow:
- A. Interior: type 302 stainless steel. Cover plate mounting screws shall be slotted head oval screws and shall match the finish and material of the plate and shall be furnished with the plate by the plate manufacturer.
 - B. Exterior, exposed work and wet locations: cover plates shall be extra-duty rated (NEC 406.9(B)(1)) galvanized cast ferrous metal, standard size, and shall be single or ganged as indicated on the drawings. Exterior mounted switch and receptacle plates, and those noted to be weatherproof, shall be weatherproof cover plates, standard size, single or ganged as indicated on the drawings, and shall be "approved" third party listed as "rain-tight while in use."
- 2.5 All devices shall have a hex-head green grounding screw for use in connecting device to green grounding conductor run in the conduit system.
- 2.6 All GFI devices shall be the feed through type.
- 2.7 All standard duplex receptacles shall be 20-amp, 125 volt rated.
- 2.8 All devices subject to use in a wet location shall be listed as weather resistant.
- 2.9 All switches shall be rated 20-amp, 120/277 volt. Toggle switches shall have quiet operating mechanisms without the use of mercury switches.

PART 3 - EXECUTION

- 3.1 Mounting height shall be as indicated on the Drawings. Coordinate with other trades so that devices will miss equipment installed by others.
- 3.2 Where two or more devices are ganged, they shall be in a common box with a ganged plate.
- 3.3 All devices shall have a green ground conductor to run parallel with the phase conductor back to the electrical panel.
- 3.4 In all areas where carpet is to be installed as finished floor material, unless otherwise specified, the Electrical Contractor will furnish solid brass carpet flanges for installation on floor outlet boxes. Flanges will be furnished and installed on all active outlets after the carpet is installed. Where a specified number of outlet fittings are to be furnished to the Owner, for each fitting not installed during the construction period, it will be turned over to the Owner with the receptacle, carpet flange and all necessary appurtenances.
- 3.5 Provide quantity of 2% spare cover plates of each type to the owner.

END OF SECTION 262726

SECTION 262727 - DISCONNECTS

PART 1 - GENERAL

- 1.1 Disconnect switches shall be provided where indicated on the drawings, or as required by the National Electrical Code (NEC).

PART 2 - PRODUCT

- 2.1 Disconnects shall be heavy duty as manufactured by Square D Company, Siemens, Eaton or ABB.
- 2.2 Disconnects shall be furnished with factory finish paint and appropriate knockouts for conduit connections.
- 2.3 All disconnects shall have side hinged type doors. Front operated handles will not be permitted.
- 2.4 All fused disconnects shall be equipped with positive pressure fuse clips and shall have visible disconnecting blade switches.
- 2.5 NEMA 1 enclosures shall be provided where installed indoors. NEMA 3R enclosures shall be provided where exposed to the elements, unless noted otherwise.
- 2.6 All disconnects shall have copper bus.
- 2.7 Disconnects shall have provisions for locking in on and off positions.
- 2.8 Disconnects shall have defeatable door interlocks that prevent the door from opening when the operating handles is in the "on" position.
- 2.9 Disconnects shall have handles whose positions are easily recognizable in the "on" or "off" position. For safety reasons, padlock shall be provided for switches located in the public areas.
- 2.10 Required fuses shall be manufactured by Eaton-Bussman, Littelfuse, Mersen or approved equivalent.

PART 3 - EXECUTION

- 3.1 Disconnect switches shall be mounted as indicated on the Drawings and shall be independently supported. Conduits entering the disconnect switch shall not be used to support switches.
- 3.2 Where fused disconnect switches are required or shown on the plans, standard fuses shall be used unless the switch protects an individual motor circuit, then dual element fuses shall be used.
- 3.3 The electrical contractor shall provide to the owner the spare fuses, 10% of the quantity of fuses used of each type and rating, with a minimum of one set of each type.

END OF SECTION 26 27 27

SECTION 263213 – STANDBY POWER GENERATOR SET

PART 1 - GENERAL

- 1.1 The Contractor shall furnish a standby power generator set as indicated on the drawings and contained herein. The Contractor shall supply all parts for a complete, functioning generator set.
- 1.2 All materials, equipment, and parts comprising the units specified herein, shall be new and unused, of current manufacture and of highest grade.
- 1.3 The engine, generator and all major items of auxiliary equipment shall be manufactured by manufacturers currently engaged in production of such equipment. The unit shall be furnished by an authorized dealer having a parts and service facility within 150 miles of the project site.
- 1.4 The generator set shall be as manufactured by Caterpillar, Cummins, Kohler, or Generac.

PART 2 - PRODUCT

- 2.1 Generator Set Characteristics
 - A. Acceptable Unit Generac SG175 or approved equivalent
 - B. Rating @ 1800 RPM. The rating of the engine-generator system shall be based on operation of the set when equipped with all necessary operating accessories such as radiator fan, air cleaners, etc.
 1. Standby power KW with fan: 175 KW
 2. Standby power KVA with fan: 218.75 KVA
 3. Voltage 208 Volts
 4. Power factor .8
 5. Frequency 60 hertz
 - C. These ratings must be substantiated by manufacturer's standard published curves. Special ratings or maximum ratings are not acceptable.
 - D. Set shall be capable of continuous operation for a minimum period of 30 days without damage at the standby rating.
- 2.2 Engine
 - A. The engine shall be water cooled inline or Vee-type, four cycle compression ignition. It shall meet specifications when operating on commercially available natural gas. The engine shall

be equipped with fuel solenoid shut off, gas strainer, lube oil and intake air filters; unit mounted radiator cooling, and water pump.

- B. The engine electronic governor shall maintain frequency regulation not to exceed +/- 0.25% (isochronous) from no load to full rated load.
- C. The unit shall be mounted on a structural steel sub- base and shall be provided with vibration control by use of integral means or spring-type isolators as recommended by the manufacturer.
- D. Safety shut-offs for high water temperature, low oil pressure, overspeed, and engine overcrank shall be provided.

2.3 Generator

- A. The generator shall be a salient pole brushless, synchronous alternator, continuous rated, .8 P.F., 218.75 KVA, 175 KW. The unit shall be the single bearing type. This assembly shall be compact, sturdy and free from vibration and with a minimum noise level. The generator rotating speed shall not exceed 1800 revolutions per minute.
- B. Stator insulation shall be Class "F", rated for 80 degrees Celsius rise by resistance above a 40 degrees Celsius ambient, continuous duty. The stator windings shall be designed for an output of 3 phase, 60 hertz, 480 volts and shall have an overload capacity of 25% for two (2) hours out of any twenty-four (24) hour period.
- C. The generator-exciter-regulator package shall provide a voltage regulation of plus and minus 1% of rated voltage. Voltage regulation shall apply to any load from no load to rated load at rated power factor, and is defined as a change in the output voltage after all transients, due to load change, have decayed to zero.
- D. With the generator operating at rated speed, rated voltage, no-load, the sudden application of rated load, rated power factor shall not cause a transient voltage deviation of more than 15% from rated voltage. Following such a sudden load change, the voltage shall recover to and remain within the regulation band within 2 seconds.
- E. Amortisseur windings with the end plates connected between poles shall be included for minimized harmonic content, good transient performance and to provide paralleling capability.
- F. The bearings shall be so located as to enable replacement without disturbing the exciter-rectifier- rotor assembly. The generator shaft shall be sufficiently rigid to avoid torsional vibration. The torsional analysis of the shaft shall be done by the engine supplier. The generator shall be equipped with an adequately sized conduit box for making external connections to the connected load.
- G. Voltage regulation shall be accomplished by an automatic volts-per-hertz type, solid state, exciter/regulator shock mounted inside the generator.
- H. A resettable line current sensing circuit breaker with inverse time versus current response shall be furnished which protects the generator from damage due to its own high current

capability. This breaker shall not automatically reset preventing restoration of voltage if maintenance is being performed. Field current- sensing breaker will not be acceptable.

2.4 Cooling System

- A. An engine-mounted radiator with blower type fan shall be sized to maintain safe operation at 110 degrees Fahrenheit maximum ambient temperature. The radiator shall be equipped with a duct adapter flange. Air flow restriction from the radiator shall not exceed 0.5" H2O. The Contractor shall provide ductwork with flexible connecting section between radiator duct flange and discharge louver frame.
- B. Intake louvers shall be sized and located to provide sufficient intake air for engine combustion, ventilating air, and to provide required air flow through the radiator. These louvers shall be by the Electrical Contractor unless noted otherwise.
- C. The engine cooling system shall be filled with a solution of 50% ethylene glycol.

2.5 Fuel System

- A. Provide piping to the generator from the natural gas supply.
- B. Flexible fuel connectors and solenoid valve shall be provided by the generator manufacturer.

2.6 Exhaust System

- A. A suitable silencer of the reactive type shall be furnished with the engine. Critical 25-30 Db reduction.
- B. A stainless steel bellows type exhaust adaptor at least 18 inches long shall be furnished for each exhaust outlet to the silencer.

2.7 Automatic Starting System

- a. A12 or 24 volt DC electric starting system with positive engagement drive shall be furnished.
- b. Fully automatic generator set start/stop controls in the generator control panel shall be provided. Controls shall provide shutdown for low oil pressure, high water temperature, overspeed, overcrank, and one auxiliary contact for activating accessory items. Controls shall include a 30 second single cranking cycle limit with lockout.
- c. A unit mounted thermal circulation type water heater shall be furnished to maintain engine jacket water to 90 degrees Fahrenheit in an ambient temperature of 30 degrees Fahrenheit. The heater shall be single phase, 60 Hertz, 120 volts, 1500 watts.

2.8 Batteries

- A. The batteries shall be 12 volt maintenance free, lead acid type of suitable capacity to provide 90 seconds of total cranking time at 0 degrees Fahrenheit without recharging and will be rated per manufacturer's recommendation.

- B. The battery will be supplied with all necessary intercell and intertray connectors, battery rack, cables, clamps, charged and ready for service.

2.9 Battery Charger

- A. The charger shall be rated at no less than 10 amps and employ transistor controlled magnetic amplifier circuit to provide continuous taper charging.
- B. The charger shall maintain rated output voltage with A.C. line fluctuations of +/- 10%.
- C. The charger shall contain:
 - 1. Two ranges, float at 1.4 V.P.C. and equalize at 1.6 V.P.C. on maintenance free lead acid batteries.
 - 2. Automatic A.C. line compensation.
 - 3. Automatic overload protection (current limiting).
 - 4. Silicon diode full-wave rectifiers.
 - 5. Automatic surge suppressors.
 - 6. D.C. ammeter and voltmeter.
 - 7. Fused A.C. input and D.C. output.
 - 8. Low D.C. voltage alarm relay.
 - 9. High D.C. voltage alarm relay.
- D. A.C. input voltage shall be 120 volt A.C.

2.10 Generator Control Panel

- A. A generator mounted NEMA 1 type vibration isolated control panel made from 14 gauge steel shall be provided on the unit, unless otherwise noted.
- B. Panel shall contain, but not be limited to, the following equipment:
 - 1. Voltmeter, 3 1/2", 2% accuracy.
 - 2. Ammeter, 3 1/2", 2% accuracy.
 - 3. Ammeter/Voltmeter phase selector switch.
 - 4. Frequency meter, 3 1/2", dial type.
 - 5. Automatic starting controls as specified in 7.b.

6. Panel illumination lights and switch.
7. Voltage level adjustment rheostat.
8. Engine oil pressure gauge.
9. Engine water temperature gauge.
10. Dry contacts for remote alarms wired to terminal strips.
11. Fault indicators for low oil pressure, high water temperature, overspeed, overcrank, and not in "auto" position.
12. Four position function switch; "auto", "manual", "off/reset", and "stop".
13. Battery charging ammeter.
14. One set of louver contacts.
15. Running time meter.

2.11 Main Line Circuit Breaker

- A. A generator mounted main line molded case circuit breaker rated 100 amps shall be installed as a load circuit interrupting and protection device. It shall operate both manually for normal switching function and automatically during overload and short circuit conditions. Shunt trip to activate on engine fault condition.
- B. The trip unit for each pole shall have elements providing inverse time delay during overload conditions and instantaneous magnetic tripping for short circuit protection. The circuit breaker shall meet standards established by Underwriters' Laboratories, National Electric Manufacturer's Association, and National Electrical Code.
- C. Generator exciter field circuit breakers do not meet the above electrical standards and are unacceptable for line protection.

2.12 Pre-Alarm Module

- A. A generator control panel mounted pre-alarm module shall be provided to meet NFPA 76A.
- B. It shall provide audible and visual alarm warning of impending fault conditions and provide audible warning on fault shutdown.
- C. Provide a Beacon and horn to signal fault shut down.

2.13 Provide sound attenuated weatherproof enclosure.

2.14 Provide emergency shut down push button located outside generator enclosure in compliance with NEC 445.18 (B).

PART 3 - EXECUTION

- 3.1 The generator set shall be warranted by the generator set manufacturer for one year from the date of acceptance. The warranty shall cover all parts and labor. Extended warranty and maintenance shall be made available to the Owner after the date of acceptance.
- 3.2 The generator set shall receive the manufacturer's standard factory load testing. Prior to acceptance of the installation, equipment shall be tested to show that it is free of any defects, and will start automatically, and be subjected to full load test, or that load which is available at the job site.
- 3.3 On completion of the installation, start-up shall be performed by a factory-trained dealer service representative. A letter shall be written to the Engineer from the factory-trained dealer, certifying that the system has been installed and field tested to meet the above performance requirements.
- 3.4 Operating and maintenance instruction books shall be supplied upon delivery of the unit and procedures explained to operating personnel.
- 3.5 Provide a 6" high concrete pad of sufficient size and structure to support the generator and enclosure.
- 3.6 For additional requirements see "Requirements for Permanently Installed Emergency Generator Systems" as published by the NC Department of Insurance. In instances where this specification conflicts with the above document, the more stringent requirement shall govern.

END OF SECTION 263213

SECTION 263623 - AUTOMATIC TRANSFER SWITCH

PART 1 - GENERAL

- 1.1 The Contractor shall furnish an automatic transfer switch as shown on the drawings and as specified herein.
- 1.2 When an emergency generator system or prime power system is furnished as part of the work, the subcontractor furnishing the generator equipment shall furnish the automatic transfer switch.
- 1.3 Transfer switch(es) shall be as manufactured by Generac, Zenith, Kohler or ASCO.
- 1.4 The automatic transfer switch shall be contactor type, with arc suppression chutes.

PART 2 - PRODUCT

- 2.1 The transfer switch(es) shall be 208 volt rated 800 amp, three (3) phase, four (4) wire, four (4) pole with adjustable time-delayed neutral transfer. The transfer switch(es) shall be capable of switching all classes of load and shall be rated for continuous duty when installed in a Nema 1 enclosure constructed in accordance with Underwriters' Laboratories, Inc. Standard UL-1008.
- 2.2 Automatic Operation: Transfer switch(es) shall automatically sense loss of line power whether the power has been cut off completely or simply dropped below 70% of the rated voltage level. After the loss of line power has been sensed, the transfer switch shall activate the engine start circuit and automatically transfer the load to the standby generator when power becomes available. When normal power returns, the transfer switch shall automatically transfer the load back to the normal source and signal the generator to shut down. The operating transfer time in either direction shall not exceed 1/6 of a second.
- 2.3 Contacts shall be silver alloy to prevent sticking and welding. Mechanism shall provide quick positive action in opening and closing circuits. All contacts and control elements shall be conveniently removable from the front of the transfer switch without major disassembly or disconnection of power conductors.
- 2.4 The control module shall be on separate panel mounted directly below switching mechanism. Sensing and control logic shall be solid-state and mounted on plug-in printed circuit boards. Printed circuit boards shall be keyed to prevent incorrect installation. Interfacing relays shall be industrial control grade plug-in type with dust covers and locking clips.
- 2.5 The automatic transfer switch shall conform to the requirements of Underwriters' Laboratories UL-1008 and shall be UL listed as follows:
 - A. For use in emergency systems in accordance with Articles 700 of the National Electrical Code.
 - B. Rated in amperes for total system transfer including control of motors, electric-discharge lamps, electric- heating and tungsten-filament lamp load.

- 2.6 The automatic transfer switch shall be rated to withstand the RMS symmetrical short circuit current available at the automatic transfer switch terminals with the type of overcurrent protection and voltage as shown on the plans.
- 2.7 The transfer switch(es) shall be equipped with a manual operator that is designed to prevent injury to the operating personnel if the electrical operator should suddenly become energized during manual transfer. The manual operator shall provide the same contact-to-contact transfer speed as the electrical operator to prevent a flashover from switching the main contacts slowly.
- 2.8 The normal and emergency contacts shall be positively interlocked mechanically and electrically to prevent simultaneous closing.
- 2.9 The switches shall include voltage and frequency sensing of the emergency source and shall be factory set to allow transfer to emergency when that source is at approximately rated voltage and frequency.
- 2.10 Approval Required
 - A. As a precondition for approval, the transfer switch(es), complete with timers, relays and accessories shall be listed by Underwriters' Laboratory, Inc. in their Electrical Construction Materials Catalogue under Standard UL-1008 (automatic transfer switches) and approved for use on Emergency Systems.
 - B. On request, the manufacturer shall provide a letter certifying compliance with all requirements of the transfer switch specifications. The certification shall identify equipment by serial number and shall include no exceptions to the specifications not stipulated with the submittal.
- 2.11 The automatic transfer switch shall also be equipped with an exerciser to start the generator and transfer the load for a period of thirty minutes once a week. After thirty minutes, the transfer switch shall switch back to the utility power source.

PART 3 - EXECUTION

- 3.1 Sequence of Operation
 - A. Engine starting contacts shall be provided to start the generating plant if any phase of the normal source drops below 70% of rated voltage, after a non- adjustable time delay period of 3 seconds, to allow for momentary dips.
 - B. The transfer switch shall transfer to emergency as soon as the voltage and frequency have reached 90% of rated. After restoration of normal power on all phase to 90% of rated voltage, an adjustable time delay period of 0-30 minutes shall delay retransfer to normal power until it has had time to stabilize.
 - C. If the emergency power source should fail during the time delay period, the time delay shall be bypassed, and the switch shall return immediately to the normal source. After the switch

has retransferred to normal, the engine-generator shall be allowed to operate at no load for an adjustable period of time (0-5 minutes) to allow it to cool before shutdown.

- D. The transfer switch(es) shall include a test switch to simulate normal power failure, pilot lights on the cabinet door to indicate the switch closed on normal or emergency, and two (2) auxiliary contacts on the main shaft; one closed on normal, the other closed on emergency.
- E. In addition, one set of relay contacts shall be provided to open upon loss of normal power supply.
- F. All relays, timers, control wiring and accessories to be front accessible.

3.2 Submittal, Operator's Manual and Warranty

- A. Submittal shall include specification sheets showing all standard and optional accessories to be supplied; schematic wiring diagrams; dimension drawings; and interconnection diagrams identifying by terminal number each required interconnection between the generator set, the transfer switch, and the remote annunciator panel if it is included elsewhere in these specifications.
- B. Each transfer switch shall be provided with an operator's manual providing installation and operating instructions.
- C. The automatic transfer switch and generator set shall be warranted by the generator set manufacturer for one year from the date of acceptance. The warranty shall cover all parts and labor. Extended warranty offers shall be made available to the Owner after the date of acceptance.

3.3 A letter of certification from a factory representative shall be furnished to the Engineer stating that the automatic transfer switch(es) has been installed in accordance with the manufacturer's instructions, and that the switch has been tested for compliance with the above performance requirements.

3.4 For additional requirements see "Requirements for Permanently Installed Emergency Generator Systems" as published by the NC Department of Insurance. In instances where this specification conflicts with the above document, the more stringent requirement shall govern.

END OF SECTION 263623

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SECTION 265100 - LIGHTING FIXTURES

PART 1 - GENERAL

- 1.1 The Contractor shall provide all fixtures and lamps where indicated on the Drawings.
- 1.2 Work shall include all stems, canopies and accessories necessary for a complete lighting fixture installation.
- 1.3 No PCB ballasts shall be accepted.
- 1.4 All lighting systems shall comply with the 2018 North Carolina State Energy Code.

PART 2 - PRODUCT

- 2.1 Fixtures shall be as specified in the Fixture Schedule or approved equivalents.
- 2.2 All outdoor fixtures shall bear the approved third-party test label for damp or wet locations as applicable. Where the ambient temperature falls below 35°F all LED fixtures and drivers shall be rated for operation at 0°F.
- 2.3 Unless otherwise noted, all fixtures shall be new, free of defects and imperfections. Damaged fixtures shall be replaced at this Contractor's expense.
- 2.4 All acrylic lenses for lay-in troffers and wrap around fixtures shall have a nominal lens thickness of 0.125" unless noted otherwise on plans.
- 2.5 LED Luminaries:
 - A. LED driver manufacturers should have a minimum of five years of experience with the manufacture of LED drivers. All drivers shall have a minimum warranty of five years.
 - B. Fixtures shall be dimmable down to 1% with standard 120/277-volt, electronic, low voltage dimmers.
 - C. Minimum color rendering index (CRI) shall be 80. Color temperature and performance shall conform to the parameters established by ENERGY STAR SSL standards (refer to ANSI-C78.377-2008).
 - D. Optical design shall be low glare, 50% cut-off.
 - E. Rated for 50,000 hours at 70% lumen maintenance.
 - F. LED driver shall be high efficiency with a minimum power factor of .90
 - G. 5-year, 100% warranty coverage for the driver, LED module, housing and trim. For the 1st year this shall be a complete parts and labor warranty. The 4th and 5th years shall cover parts only.
- 2.6 Emergency Exit Lights
It shall be completely self-contained, provided with maintenance-free battery,

automatic charger, and other features. Luminaire must be third-party listed as emergency lighting equipment, and meet or exceed the following standards: NEC, N.C. Building Code, Energy Code, NFPA-101, and NEMA Standards.

- A. **Battery**
It shall be sealed, maintenance-free type, with minimum of 90 minutes operating endurance. Must have a normal life expectancy of 10 years. Batteries shall be a high temperature type with an operating range of 0 degree C to 60 degrees C and contain a resealable pressure vent, a sintered + positive terminal and – negative terminal.
- B. **Charger**
It shall be fully automatic solid-state type, full wave rectifying, with current limiting. Charger shall restore the battery to its full charge within 24 hours after a discharge of 90 minutes under full rated load. The unit shall be activated when the voltage drops below 80 percent. A low voltage disconnect switch shall be included if LEAD Battery is used, to disconnect the battery from the load and prevent damage from a deep discharge during extended power outage.
- C. **Additional Features**
Pilot light to indicate the unit is connected to AC power. The battery shall have high rate charge pilot light, unless self-diagnostic type. A test switch to simulate the operation of the unit upon loss of AC power by energizing the lamps from the battery. This simulation must also exercise the transfer relay.
- D. **Warranty**
The entire unit shall be warranted for three years. The battery must have an additional two more years pro-rated warranty. Warranty shall start from the date of project final acceptance. Warranty shall be included in the contract document.
- E. **LED**
The use of LED is required due to their reliable performance, low power consumption, and limited maintenance requirements. Maximum LED failure rate shall be 25% within a seven (7) year period; otherwise, if exceeded, manufacturer shall replace the complete unit at no charge to the owner.
- F. **Unit Test**
Contractor shall perform a test on each unit after it is permanently installed and charged for a minimum of 24 hours. Battery shall be tested for 90 minutes, in accordance with NEC 700. The battery test shall be done 10 days prior to final inspection. Any unit which fails the test must be repaired or replaced and tested again. Copy of the test report shall be made available for the owner and engineer.

PART 3 - EXECUTION

- 3.1 All fixtures shall be installed in accordance with the National Electric Code.
- 3.2 All fixtures other than the lay-in type shall be individually supported from building structure with 1/4" threaded rods and nuts.
- 3.3 Where a recessed or downlight fixture replaces a section or part of a ceiling tile, fixture is to be supported at the two (2) opposite ends to the steel frame of the building. Supports shall be

- provided with the same type of wire as used to support the lay-in ceiling track. Attach one end of the wire to one corner of the luminaire and the other end to the building's structural system. For fire rated suspended ceiling, luminaire shall be supported to the Building Structure as per the Ceiling Design Criteria.
- 3.4 The complete emergency lighting system shall be tested by throwing the circuit breakers feeding the emergency lighting circuits. One and one-half hours thereafter, the battery voltages shall be recorded in a report to be submitted to the Engineer. This test shall be performed just prior to final inspection, under witness of the electrical inspector, and in accordance with NEC Articles 700.3 (A) and (D).

END OF SECTION 265100

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SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Standards set forth by the North Carolina Department of Environmental Quality (NCDEQ) Division of Energy, Mineral and Land Resources.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Removal of trees and other vegetation.
 - 2. Clearing and grubbing.
 - 3. Removing above-grade improvements.
 - 4. Removing below-grade improvements.
- B. Related Sections:
 - 1. Division 31 Section "Earth Moving".
 - 2. Division 31 Section "Erosion Controls".

1.3 PROJECT CONDITIONS

- A. Traffic: Conduct site-clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from authorities having jurisdiction.
- B. Protection of Existing Improvements: Provide protections necessary to prevent damage to existing improvements indicated to remain in place.
 - 1. Protect improvements on adjoining properties and on Owner's property.
 - 2. Restore damaged improvements to their original condition, as acceptable to property owners.
 - 3. All erosion control measures shall be in place prior to commencement of clearing operations.
- C. Protection of Existing Trees and Vegetation: Protect existing trees and other vegetation indicated to remain in place against unnecessary cutting, breaking or skinning of roots, skinning or bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary guards to protect trees and vegetation to be left standing.
 - 1. Water trees and other vegetation to remain within limits of contract work as required to maintain their health during course of construction operations.
 - 2. Provide protection for roots over 1-1/2 inch (38 mm) in diameter that are cut during construction operations. Coat cut faces with an emulsified asphalt or other acceptable

- coating formulated to use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible.
3. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations in a manner acceptable to Engineer. Employ a licensed arborist to repair damage to trees and shrubs.
 4. Replace trees that cannot be repaired and restored to full-growth status, as determined by arborist.
- D. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated or directed.

1.4 EXISTING SERVICES

- A. General: Indicated locations are approximate; determine exact locations before commencing Work.
- B. Arrange and pay for disconnecting, removing, capping, and plugging utility services. Notify affected utility companies in advance and obtain approval before starting this Work.
- C. Place markers to indicate location of disconnected services. Identify service lines and capping locations on Project Record Documents.

PART 2 – PRODUCTS

None Used.

PART 3 – EXECUTION

3.1 SITE CLEARING

- A. General: Remove trees, shrubs, grass, and other vegetation, improvements, or obstructions, as required, to permit installation of new construction. Remove similar items elsewhere on site or premises as specifically indicated. Removal includes digging out and off-site removal of stumps and roots.
 1. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
 2. Existing trees within clearing limits may be chipped and stockpiled on-site but shall NOT be used as landscaping mulch or fill.
- B. Clearing and Grubbing: Clear site of trees, shrubs, and other vegetation, except for those indicated to be left standing.
 1. Completely remove stumps, roots, and other debris protruding through ground surface.
 2. Use only hand methods for grubbing inside drip line of trees indicated to remain.
 3. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.
 - a. Place fill material in horizontal layers not exceeding 6 inches (150 mm) loose depth, and thoroughly compact each layer to a density equal to adjacent original ground.

- C. Topsoil Stripping: Strip and stockpile existing topsoil within construction limits for re-spreading. Should the Contractor elect to remove topsoil from the site, suitable topsoil from off-site sources shall be provided for re-spreading at no cost to the Owner.
 - 1. Remove sod and grass before stripping topsoil.
 - 2. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials. All surface topsoil, regardless of thickness encountered, shall not be considered Unsuitable Soil.
 - 3. Remove subsoil and non-soil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.
 - 4. Stockpile topsoil materials within construction limits and away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 5. Do not stockpile topsoil within tree protection zones.
 - 6. Dispose of excess topsoil off-site.
- D. Removal of Improvements: Remove existing above-grade and below-grade improvements as indicated and as necessary to facilitate new construction.
 - 1. Abandonment or removal of certain underground pipe or conduits may be indicated on mechanical or electrical drawings and is included under work of related Division 22 Sections. Removing abandoned underground piping or conduits interfering with construction is included under this section.

3.2 DEMOLITION PREPARATION

- A. Conduct demolition operations and remove debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations or as shown on the drawings.
- B. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around selective site demolition area.
 - 1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction or as shown on the plans.
 - 2. Protect existing site improvements, appurtenances, and landscaping to remain.
 - 3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
 - 4. Provide temporary weather protection, during interval between demolition and removal of existing construction, on exterior surfaces and new construction to ensure that no water leakage or damage occurs to structure or interior areas.
- C. Provide and maintain exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of building to be selectively demolished.
 - 1. Strengthen or add new supports when required during progress of selective demolition.

- D. Protect trees, fences, poles, mailboxes, and all other property unless their removal is authorized. Any property damaged, that is not authorized for removal, shall be restored or replaced to the Owner's satisfaction.

3.3 UTILITY SERVICES

- A. Maintain existing utilities indicated to remain in service and protect them against damage during selective site demolition operations.
 - 1. Do not interrupt existing utilities serving occupied or operating facilities, except when authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to governing authorities.
 - a. Provide not less than 72 hours' notice to Owner if shutdown of service is required during changeover.
- B. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services serving building to be selectively demolished.
 - 1. Arrange to shut off indicated utilities with utility companies.
 - 2. Where utility services are required to be removed, relocated, or abandoned, provide bypass connections to maintain continuity of service to other parts of the building before proceeding with selective demolition.
- C. Utility Requirements: Refer also to Division 15 and 16 Sections for additional requirements for shutting off, disconnecting, removing, and sealing or capping utility services. Do not start selective site demolition work until utility disconnecting and sealing have been completed and verified in writing.
- D. Utility Adjustments and Relocations: Adjust locations, elevations and routes of existing utility lines, poles, guys, vaults, handholes, boxes, and other related appurtenances as required to facilitate new construction. Coordinate adjustments and relocations with utility companies.

3.4 POLLUTION CONTROLS

- A. Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations.
 - 1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
- B. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective site demolition operations. Return adjacent areas to condition existing before start of selective demolition.

3.5 SELECTIVE SITE DEMOLITION

- A. Demolish and remove existing construction only to the extent required by new construction and as indicated on the drawings. Use methods required to complete Work within limitations of governing regulations.
 - 1. Dispose of demolished items and materials promptly. On-site storage or sale of removed items is prohibited.
 - 2. Return elements of construction and surfaces to remain to condition existing before start of selective demolition operations.
- B. Demolish asphalt, concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain, using power-driven masonry saw or hand tools; do not use power-driven impact tools.
- C. Remove sawcut concrete and asphalt, including aggregate base, to a depth of 12-inches below existing, adjacent grade, or as indicated. Provide neat sawcut at limits of pavement removal as indicated.

3.6 PATCHING AND REPAIRS

- A. Promptly patch and repair holes and damaged surfaces caused to adjacent construction by selective site demolition operations.
- B. Where repairs to existing surfaces are required, match previous work as closely as possible.
 - 1. Completely fill holes and depressions in existing masonry walls to remain with an approved masonry patching material, applied according to manufacturer's printed recommendations.
- C. Restore exposed finishes of patched areas and extend finish restoration into adjoining construction to remain in a manner that eliminates evidence of patching and refinishing.

3.7 CLEANING

- A. Keep the site free from debris and hazards and inspect the site at the end of each day for trash. All adjacent roads and drives outside of the construction fencing shall remain in operation during construction and shall remain free of all construction materials and debris.

3.8 DISPOSAL OF WASTE MATERIALS

- A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
- B. Burning on Owner's Property: Burning is not permitted on Owner's property.
- C. Removal from Owner's Property: Remove waste materials and unsuitable or excess soils and mulch from Owner's property. Transport demolished materials off Owner's property and legally dispose of them.

END OF SECTION 311000

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SECTION 312000 – EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Report of Subsurface Investigation.
 - 1. The geotechnical report is available to bidders as general information with regard to project and site conditions. However, the geotechnical report is not a part of the contract documents and is not a warranty or guarantee of subsurface conditions. Variations in subsurface conditions should be anticipated. Bidders should carefully inspect the site prior to bidding and will be provided reasonable access to perform independent explorations of subsurface conditions, if requested.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Preparing and grading subgrades for walks, lawn areas, and landscaping.
 - 2. Excavating, filling and backfilling for structures.
 - 3. Base course for walks and pavements.
 - 4. Subsurface drainage backfill for trenches.
 - 5. Excavating and backfilling trenches.
- B. Related Sections: The following Sections contain requirements that relate to this Section.
 - 1. Division 01 Sections for allowances, definitions and procedures.
 - 2. Division 31 Section "Site Clearing" for site stripping, grubbing, topsoil removal, and tree protection.
 - 3. Division 33 Section "Storm Drainage Utilities" for storm drainage.
 - 4. Division 32 Section "Planting" for finish grading, including placing and preparing topsoil for permanent and temporary grass seeding.
 - 5. Division 31 "Erosion and Sediment Controls", for all areas of the site that are graded or disturbed by any construction operations

1.3 UNIT PRICES

- A. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following:
 - 1. 24 inches outside of concrete forms other than at footings.
 - 2. 12 inches outside of concrete forms at footings.
 - 3. 6 inches outside of minimum required dimensions of concrete cast against grade.
 - 4. 6 inches beneath bottom of concrete slabs on grade.
 - 5. 6 inches beneath invert elevation of pipe in trenches, and the greater of 24 inches wider than pipe diameter or 42 inches wide.

6. Additional rock removed beyond the limits outlined above to accommodate trench boxes or other removal methods shall not be included in the payment volume.
- B. Unsuitable Soil Measurement: Volume of soil actually removed, measured in original position, but not to exceed the limits directed by the Owner's Independent Testing Agency.
 1. Additional soil excavated beyond the limits directed by the Owner's Independent Testing Agency; including lay-back of excavation walls, excavation to accommodate trench boxes or other shoring, etc.; shall not be considered Unsuitable Soil.
- C. Replacement Material Measurement: Volume exactly equal to that of the unsuitable soil or rock that was removed, measured in original position.
- D. Unit prices for unsuitable soil and rock removal shall include all work and materials as defined in Division 01 sections.

1.4 DEFINITIONS

- A. Excavation consists of the removal of material encountered to subgrade elevations and the reuse or disposal of materials removed. Refer to the following section for additional definitions of classified excavations.
- B. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below base course, drainage fill, or topsoil materials.
- C. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.
- D. Surface Course: The top layer of the pavement structure placed on base course or subgrade.
- E. Base Course: Layer placed between the subgrade elevation and asphalt paving courses.
- F. Bedding Course: Layer placed over excavated subgrade in a trench before laying pipe.
- G. Unauthorized excavation consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the Architect. Unauthorized excavation, as well as remedial work directed by the Architect, shall be at the Contractor's expense.
- H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.
- I. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within building lines.

1.5 EXCAVATION CLASSIFICATIONS

- A. Excavation Classifications: All excavation is classified as General Excavation except for Mass Rock, Trench Rock and Unsuitable Soil Materials as defined in this section.

1. General Excavation: Excavation, removal and/or disposal of pavements and other obstructions visible on surface; underground structures, utilities, and other items indicated to be demolished and/or removed; together with soil, boulders, and other materials encountered that are not classified as rock, unsuitable soil, or unauthorized excavation.
 - a. Intermittent drilling, blasting, or ripping to increase production and not necessary to permit excavation of material encountered will be considered general excavation.
 - b. Soil (regardless of nature) or other debris encountered above proposed subgrade elevations shall be considered general excavation unless determined by the Architect to meet the definition of rock.
 - c. In-place densification by vibratory rolling of existing soils at exposed subgrades, as described herein, shall be considered General Excavation.
2. Unsuitable Soil Excavation: Removal and disposal of soil materials or other debris encountered below proposed subgrade elevations which is deemed unsuitable to remain in place by the Architect or Owner's Independent Testing Agency.
 - a. Soil and/or other debris encountered above proposed subgrade elevations shall be considered general excavation.
 - b. Soil material which, in the opinion of the Architect or Owner's independent testing agency, can be repaired by scarifying, drying and recompact or material which is made unsuitable by delay of work, lack of protection or other actions of the Contractor or his Sub-Contractors shall not be considered as unsuitable soil and shall be repaired or replaced by the Contractor at no additional cost to the Owner. Moisture content alone shall not be the determining factor as to the presence of unsuitable soil.
 - c. Any material moved or removed without the measurement by the Owner's independent testing agency and approval by the Architect will be considered as general excavation.
 - d. Surface topsoil, regardless of thickness encountered, shall not be considered unsuitable soil.
 - e. Stones, rocks and boulders not meeting classifications of rock shall not be considered unsuitable soil. Stones, rocks and boulders shall be removed from soil as necessary if soil is to be used as fill or backfill. Removed stones, rocks and boulders shall be removed from the site.
 - f. The unsuitable soil allowances shall be for unsuitable soils only and not for repair of weather related deterioration of subgrade. These Allowances are not for required on-site cut and off-site fill necessary to bring subgrades and grades to elevations shown on drawings. Contractor shall be responsible for proper drying and dewatering procedures, as necessary, as part of his normal operations.
3. Mass rock Excavation: Removal, in Open Excavations, of rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1.5-cu.yd. that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted. In the event rock (as defined above) is encountered, the Contractor shall immediately notify the Architect.

- a. **Mass Rock Excavation Equipment:** Late-model, track-type CAT D-8 crawler tractor operating at one mile per hour in the lowest available gear, and at the highest normal operating rpm pulling a sharp, single-toothed ripper. The Contractor shall provide equipment specification and test data verifying that the equipment to be used for demonstration purposes complies with the minimum requirements. The equipment shall be in good repair and in proper working condition. The Owner reserves the right to inspect and approve the equipment to be used for demonstration purposes. The Contractor shall demonstrate (at no additional cost) to the Architect or Owner's independent testing agency that the rock cannot be practically ripped with equipment equivalent that specified above without systematic drilling and blasting. Mass rock is defined as material which, after 1 hour of continuous ripping using the equipment described above, produces less than 30 cubic yards of removable material.
4. **Trench Rock Excavation:** Removal, in Trench Excavations, of rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1.0-cu.yd. that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted. In the event rock (as defined above) is encountered, the Contractor shall immediately notify the Architect.
 - a. **Trench rock excavation equipment:** Late-model, track mounted CAT 330 or equivalent hydraulic excavator equipped with a narrow (36" max) bucket with new rock teeth and operating at the highest normal operating RPM. The Contractor shall provide equipment specification and test data verifying that the equipment to be used for demonstration purposes complies with the minimum requirements. The equipment shall be in good repair and in proper working condition. The Owner reserves the right to inspect and approve the equipment to be used for demonstration purposes. Trench rock is defined as material which, after 1 hour of continuous digging using the equipment described above, removes less than 10 cubic yards of material.
5. **Classified excavation requirements:**
 - a. Excavations more than both 10 feet in width and more than 30 feet in length are defined as Open Excavations. Excavations less than both 30 feet in width and less than 30 feet in length are defined as Trench Excavations.
 - b. Contractor shall expose and clean the rock material for inspection and measurement by the Architect.
 - c. Do not excavate rock or unsuitable soil until it has been classified and cross-sectioned by the Owner's independent testing agency or Architect. Any material moved or removed without the measurement by the Owner's independent testing agency and approval by the Architect will be considered as General Excavation.
 - d. The Architect shall be the final judge on what is classified as unsuitable or rock excavation.
 - e. The contractor may be required to provide equipment specification data verifying that the above minimum-rated equipment will be used for demonstration purposes. The equipment shall be in good repair and in proper working condition.
 - f. Rippable rock, weathered rock or overburden which is not classified as rock according to the above definitions shall be considered General Excavation.

1.6 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Test Reports: In addition to test reports required under field quality control, submit the following:
 - 1. Laboratory analysis of each soil material proposed for fill and backfill from on-site and borrow sources.
 - 2. One optimum moisture-maximum density curve for each soil material.
 - 3. Reports of all laboratory and field tests including evaluations of subgrades and foundation bearing conditions.
 - 4. As-built survey of athletic fields, courts and tracks demonstrating compliance with specified tolerances.
 - 5. Reports of Special Inspections.
- C. Blasting plan approved by authorities having jurisdiction if applicable due to on-site rock.
- D. Report of rock or unsuitable soil removal with quantities confirmed in writing by the Architect or Owner's independent testing agency.

1.7 QUALITY ASSURANCE

- A. Codes and Standards: Perform earthwork complying with requirements of authorities having jurisdiction. Any earthwork required for preparation of parking areas and drives shall comply with current NCDOT Standard Specifications as per the North Carolina Construction Manual.
- B. Comply with applicable requirements of NFPA 495--Explosive Materials Code.
- C. Testing and Inspection Service: Owner will employ a qualified independent geotechnical engineering testing agency to classify proposed on-site and borrow soils to verify that soils comply with specified requirements and to perform required field and laboratory testing.
- D. Special Inspections: Owner will employ a qualified Special Inspector or Special Inspection Agency to perform verification and inspection of earthwork construction in accordance with NC State Building Code.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1
 - 1. Before commencing earthwork, meet with representatives of the governing authorities, Owner, Architect, consultants, Geotechnical Engineer, independent testing agency, and other concerned entities. Review earthwork procedures and responsibilities including testing and inspection procedures and requirements. Notify participants at least 3 working days prior to convening conference. Record discussions and agreements and furnish a copy to each participant.

1.8 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted in writing by the Architect and then only after acceptable temporary utility services have been provided.
 - 1. Provide a minimum 48-hours' notice to the Architect and receive written notice to proceed before interrupting any utility.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shutoff services if lines are active.

1.9 PAYMENT

- A. General Excavation: All general excavation to the lines and grades indicated on the drawings including all necessary off-site disposal of excess materials and/or off-site borrow of fill materials shall be included in the base bid.
 - 1. No statement is made or implied that the on-site grading and earthwork indicated on the drawings is balanced.
- B. Unsuitable Soil Material Excavation: Unsuitable soil material excavation will be paid by unit prices included in the Contract Documents.
 - 1. Unused amounts of monies included under allowances shall be credited to the Owner by deduct change order.
- C. Rock Excavation: Mass rock and Trench rock excavation will be paid by unit prices included in the Contract Documents.
 - 1. Unused amounts of monies included under allowances shall be credited to the Owner by deduct change order.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide approved borrow soil materials from off-site when sufficient approved soil materials are not available from excavations.
- B. Satisfactory Soil Materials: ASTM D 2487 soil classification groups SP, SC, and SM; free of rock or gravel larger than 2 inches (50 mm) in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter.
 - 1. Soils placed in structural fill areas shall have a standard Proctor maximum dry density of at least 90-pcf.
 - 2. On-Site CL soils may be used in the constructed wetland area only.
- C. Unsatisfactory Soil Materials: ASTM D 2487 soil classification groups MH, CH, OL, OH, and PT.

- D. Unsuitable Soil: Refer to paragraph 1.5 of this Section.
- F. Backfill and Fill Materials: Satisfactory soil materials.
- G. Impervious Fill for Wetland Embankment or Liner: Clayey or silty soil mixtures capable of compacting to a dense state with a maximum permeability of 0.01-in/hr and compacted to at least 95% of the maximum dry density per ASTM D-698. ASTM D 2487 soil classification groups CH, CL, SC, MH, and ML; free of rock, brush, roots, and other organic material subject to decomposition.

2.2 PROCESSED AGGREGATE MATERIALS

- A. Base Course Material: Type A aggregate base course meeting the requirements of Section 520 of NCDOT "Standard Specifications for Roads and Structures."
- B. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- C. Bedding Material: #57 washed stone.
- D. Drainage Fill: #57 washed stone.
- E. Filtering Material: #57 washed stone.
- F. Coarse Sand: Grain Size Distribution (ASTM C136-95A):

<u>Sieve Size</u>	<u>Percent Passing</u>
3/8"	100
#4	95-100
#8	85-97
#16	60-80
#30	10-20
#50	5-15
#100	0-5

2.3 FLOWABLE FILL

- A. Flowable fill shall consist of a lean concrete mixture of portland cement, aggregate and water. Water reducing and air-entraining admixtures may be added at the option of the Contractor.
 - 1. Material shall comply with the requirements of Division 03 Section, Cast-in-Place Concrete.
 - 2. The proportions of the mix shall be determined by the Contractor to obtain a compressive strength of 100-300-psi at 28-days.

2.6 ACCESSORIES

- A. Drainage (Filter) Fabric: Nonwoven geotextile, specifically manufactured as a drainage geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:
 - 1. Grab Tensile Strength: 110 lbf (490 N); ASTM D 4632.
 - 2. Tear Strength: 40 lbf (178 N); ASTM D 4533.
 - 3. Puncture Resistance: 50 lbf (222 N); ASTM D 4833.
 - 4. Water Flow Rate: 150 gpm per sq. ft. (100 L/s per sq. m); ASTM D 4491.
 - 5. Apparent Opening Size: No. 50 (0.3 mm); ASTM D 4751.
- B. Separation/Stabilization Fabric: Woven geotextile, specifically manufactured for use as a separation and or stabilization geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:
 - 1. Grab Tensile Strength: 200 lbf (890 N); ASTM D 4632.
 - 2. Tear Strength: 75 lbf (333 N); ASTM D 4533.
 - 3. Puncture Resistance: 90 lbf (400 N); ASTM D 4833.
 - 4. Water Flow Rate: 4 gpm per sq. ft. (2.7 L/s per sq. m); ASTM D 4491.
 - 5. Apparent Opening Size: No. 30 (0.6 mm); ASTM D 4751.
- C. Biaxial Geogrid: Integrally formed biaxial geogrid, specifically manufactured for use as a base reinforcement for subgrade improvement. Tensar BX1100, Mirafi BXG-110, or approved equal with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:
 - 1. Aperture Dimensions: 1-in (25-mm) nominal.
 - 2. Minimum Rib Thickness: 0.03-in (0.76-mm) nominal.
 - 3. Tensile Strength @ 2% Strain: 280-lb/ft (4.1 kN/m); ASTM D-6637.
 - 4. Tensile Strength @ 5% Strain: 580-lb/ft (8.5 kN/m); ASTM D-6637.
 - 5. Ultimate Tensile Strength: 850-lb/ft (12.4 kN/m); ASTM D-6637.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
- C. Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- D. Site Maintenance: The Contractor shall be responsible to take whatever measures are necessary to ensure reasonable accessibility to and on the construction site so that undue delays are avoided under normal weather conditions. These measures shall include, but not be limited to, the following:

1. Maintaining the surface of the soils in a manner to promote drainage runoff and avoid ponding of water, especially prior to predicted rain events.
2. Avoiding operation of temporary water sources or hoses in a manner which will cause unnecessary and repeated wetting of the site.
3. Fill in severely rutted areas which are ponding water during the construction activities or after rain events with drainage fill material to assist drying and allow construction activities to continue.
4. Provide drying of surface soils and soils intended for filling or backfilling as required to promote accelerated drying of those materials.
5. After successful drying efforts or prior to predicted rain events, grade the areas back to a smooth condition to promote drainage runoff.
6. Controlling vehicular traffic, both construction and personal on the site in a manner to prevent undue damage to soils whenever possible and practical.
7. Providing temporary staging areas of crushed stone or other materials around the construction site which will better withstand the weather and traffic and keep the site accessible immediately or shortly after rain events.
8. Provide de-watering equipment for any areas collecting water which may affect construction or soil densities under built areas.
9. Any claims for weather related delays considered shall be considered with particular attention paid to the Contractor's efforts in regard to the above requirements

3.2 DEWATERING

- A. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
 2. Install a dewatering system to keep subgrades dry and convey groundwater away from excavations. Maintain until dewatering is no longer required.
- C. Design, furnish, install, test, operate, monitor, and maintain temporary dewatering systems of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
 1. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls as needed.
 2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.
 3. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, prevention of flooding in excavation, and prevention of damage to subgrades and permanent structures.
 4. Prevent surface water from entering excavations by grading, dikes, or other means.
 5. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.

6. Remove dewatering system when no longer required for construction.

- D. Soft wet soils, if present at the surface, shall be dried and compacted in place by the Contractor and be stable under proofrolling prior to placing fill. Drying shall be accomplished by discing, plowing or other means necessary and shall be included in the Contractor's bid. Site soils are typical of the area and susceptible to loss of strength if they become wet, resulting in softening and rutting during construction. Site soils are extremely moisture sensitive, therefore, the Contractor shall take active and aggressive steps to dry soil materials wet of optimum to maintain construction progress through the work and to maintain access to and around the construction. The Contractor, at his option and cost may remove unstable, wet materials and replace with available fill materials in lieu of accomplishing soil drying procedures.

3.3 EXPLOSIVES

- A. Explosives: Do not use explosives without written permission of local authorities. Contractor shall provide all consultation, engineering, supervision, expertise, experience, and test blasting as required to protect surrounding structures and to meet the performance requirements of the local authorities.

3.4 STABILITY OF EXCAVATIONS

- A. Comply with local codes, ordinances, and requirements of authorities having jurisdiction to maintain stable excavations. Contractor is responsible for ensuring all excavation operations and other construction comply with applicable OSHA requirements. Contractor shall provide temporary shoring and bracing as needed to construct the proposed improvements and comply with the above requirements.

3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
- B. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.

3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated slopes, lines, depths, and invert elevations.
1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

- B. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit, unless otherwise indicated.
 - 1. Clearance: As indicated
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove stones and sharp objects to avoid point loading.
 - 1. For pipes or conduit less than 6 inches (150 mm) in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
 - 2. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
 - 3. Where encountering rock or another unyielding bearing surface, carry trench excavation 6 inches (150 mm) below invert elevation to receive bedding course.

3.8 APPROVAL OF SUBGRADE PRIOR TO PLACING FILL OR OTHER IMPROVEMENTS

- A. Notify Architect or Owner's independent testing agency when excavations have reached required subgrade.
- B. After stripping is complete the exposed subgrade shall be proofrolled with a fully loaded dual wheel tandem axle dump truck or similar construction equipment. Four passes shall be made in each orthogonal direction. The proofrolling operation shall be observed by the Architect or Owner's independent testing agency. Should any area fail to tighten up after proofrolling and continue to rut and/or pump, the soil shall be scarified and moistened or aerated and recompacted and/or densified in-place with a vibratory roller. Repeat proofrolling operations.
- C. When Architect or Owner's independent testing agency determines that unforeseen unsuitable soil is present, continue excavation and replace with compacted backfill or fill material as directed.
 - 1. Unforeseen additional excavation and replacement with suitable material approved by the Architect will be considered unsuitable material and will be paid by unit prices included in the Contract Documents. Refer to Division 1 Sections.
- D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect. Install french drains at design subgrade if directed by the Owner's independent testing agency and approved by the Architect.

3.9 IN-PLACE DENSIFICATION OF EXISTING SOILS

- A. After removing the existing topsoil, buildings, vegetation and pavements, proposed paved areas shall be densified in-place with a medium weight vibratory roller to improve the support of the exposed subgrade soils. At least six passes across the site, with the second set of three passes perpendicular to the first set of three passes. Vibratory rolling shall be performed during dry

weather. If water is brought to the surface during vibratory rolling, discontinue rolling until the water subsides. The vibratory rolling operations shall be observed by the Owner's independent testing agency.

1. Allow pore pressures to dissipate for at least 16 hours following completion of vibratory rolling. After waiting period, perform proofrolling of the densified area.
2. Static rolling shall be performed for areas too wet for vibratory rolling.

3.10 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending indicated bottom elevation of concrete foundation or footing to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position when acceptable to the Architect.
 1. Fill unauthorized excavations under other construction as directed by the Architect or the Owner's independent testing agency.
- B. Where indicated widths of utility trenches are exceeded, provide stronger pipe, or special installation procedures, as required by the Architect.

3.11 STORAGE OF SOIL MATERIALS

- A. Stockpile excavated materials acceptable for backfill and fill soil materials, including acceptable borrow materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent wind-blown dust.
 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.12 BACKFILL

- A. Backfill excavations promptly, but not before completing the following:
 1. Acceptance of construction below finish grade including, where applicable, damp-proofing, waterproofing, and perimeter insulation.
 2. Surveying locations of underground utilities for record documents.
 3. Testing, inspecting, and approval of underground utilities.
 4. Concrete formwork removal.
 5. Removal of trash and debris from excavation.
 6. Removal of temporary shoring and bracing, and sheeting.
 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
 8. Removal of objectionable materials, including rocks larger than acceptable size, from backfill soils.

3.13 UTILITY TRENCH BACKFILL

- A. Place and compact bedding course on rock and other unyielding bearing surfaces and to fill unauthorized excavations. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

- B. Pipe sleeves and concrete backfill trenches that carry below or pass under footings and that are excavated within 18 inches (450 mm) of footings. Place concrete to level of bottom of footings. Contact the Architect or the Owner's independent testing agency to coordinate details, procedures and possible alternatives.
- C. Provide 4 inch (100 mm) thick concrete base slab support for piping or conduit less than 30 inches (750 mm) below surface of roadways. After installation and testing, completely encase piping or conduit in a minimum of 4 inches (100 mm) of concrete before backfilling or placing roadway base course.
- D. Place and compact initial backfill of satisfactory soil material or base course material, free of particles larger than 1 inch (25 mm), to a height of 12 inches (300 mm) over the utility pipe or conduit.
 - 1. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.
- E. Coordinate backfilling with utilities testing.
- F. Fill voids with approved backfill materials as shoring and bracing, and sheeting is removed.
- G. Place and compact final backfill of satisfactory soil material to final subgrade.
- H. Install detectable warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.14 FILL

- A. Preparation: Remove vegetation, topsoil, debris, wet, frozen, and unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placing fills.
 - 1. Plow, strip or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing surface.
- B. Obtain approval of subgrade as specified prior to placing fill.
- C. Obtain approval of fill materials. Remove all objectionable materials, including stones larger than acceptable size, from fill materials. Large stones may be placed in approved non-structural areas if they are spread evenly, individually and surrounded with properly compacted soil fill to ensure the absence of voids in the fill. Large stone placement in fill shall be monitored by the Owner's Independent Testing Agency.
- D. Place fill material in layers to required subgrade elevations for each location listed below.
 - 1. Under grass, use satisfactory excavated or borrow soil material.
 - 2. Under walks, pavements, buildings and other structural areas use base course material, or satisfactory excavated or borrow soil material.

3. Pond embankments, use impervious fill for core/cut-off trench and suitable soil for remainder of embankment.
- E. Following placement of fill the subgrade of building and pavement areas shall be proofrolled as described in the Field Quality Control section. The proofrolling operation shall be observed by the Owner's testing agency. Should any area fail to tighten up after proofrolling and continue to rut and/or pump, the soil shall be scarified and moistened or aerated and recompacted. Repeat proofrolling operations.

3.15 MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within ± 2 percent of optimum moisture content.
 1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
 2. Remove and replace or scarify and air-dry satisfactory soil material that is too wet to compact to specified density.
 - a. Stockpile or spread and dry removed wet satisfactory soil material.

3.15 COMPACTION

- A. Place backfill and fill materials in layers not more than 9 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill materials evenly on all sides of structures to required elevations. Place backfill and fill uniformly along the full length of each structure.
- C. Percentage of Maximum Dry Density Requirements: Compact soil to not less than the following percentages of maximum dry density according to ASTM D698 Standard Proctor:
 1. Under structures, steps, walks, and pavements:
 - a. Compact each layer of backfill or fill material at 95% of the standard Proctor Density (ASTM D-698) and the final 12-in of backfill material at 98% of the standard Proctor Density (ASTM D-698).
 - b. Moisture content of the fill during placement shall be kept within $\pm 2\%$ of optimum.
 - d. Under pavements within NCDOT rights-of-way or new pavement to be constructed to NCDOT standards compact the top 8 inches below pavement subgrade to at least 100% density in accordance with AASHTO T-99 as modified by NCDOT.
 2. Under lawn or unpaved areas, compact the top 6 inches below subgrade and each layer of backfill or fill material at 92 percent maximum dry density.
 3. In pond embankments, compact each layer of backfill or fill material at 95% of the standard Proctor Density (ASTM D-698). Moisture content of the fill during placement shall be kept within 0% to +3% of optimum.
 4. Compact each layer of aggregate base material under pavement to 100% density in accordance with AASHTO T-180 as modified by NCDOT or to at least 98% of the

nuclear target density as specified in section 520 of the NCDOT Standard Specifications for Roads and Structures.

3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - 1. Provide a smooth transition between existing adjacent grades and new grades.
 - 2. Cut out soft spots, fill low spots, and trim high spots to conform to required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Lawn or Unpaved Areas: Plus or minus 1.2 inches (0.10 foot).
 - 2. Walks: Plus or minus 1.2 inches (0.10 foot).
 - 3. Pavements: Plus or minus 1/2 inch (0.05 foot).
 - 5. Pond Embankments: Construct embankment to an elevation 10% higher than the design height to allow for settling.
- C. Lawn Areas: Grade lawn area surfaces to a smooth, even surface with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future. Remove trash, debris, stones larger than 1/2 inch in any dimension, and other objects that may interfere with planting or maintenance operations. Remove all glass, wire or other objects of any size which may cause injury. Surfaces shall be top dressed following establishment of grass as necessary to obtain smooth, consistent surface.

3.17 SUBSURFACE / FOUNDATION DRAINAGE

- A. Drainage Piping: Drainage pipe is specified in Division 33 Section "Site Storm Drainage Utilities."
- B. Subsurface Drain: Place a layer of drainage fabric around perimeter of drainage trench as indicated. Place a course of drainage fill material on drainage fabric to support drainage pipe. Encase drainage pipe in drainage fill material and wrap in drainage fabric, overlapping sides and ends at least 6 inches.
 - 1. Compact each course of drainage fill material.
 - 2. Place satisfactory excavated or borrow soil material or topsoil fill material (as appropriate) over drain to final grade.

3.18 BASE COURSES

- A. Under pavements, walks, courts and tracks, place base course material on prepared subgrades.
 - 1. Where indicated, place biaxial geogrid directly on prepared subgrade under all asphalt and concrete pavement without wrinkles or folds. Seams shall be overlapped a minimum

of 12-in. Geogrid placement shall be observed by the Owner's Independent Testing Agency prior to covering. Place compacted base course over geogrid and control traffic and operation of equipment over geogrid and base course in accordance with manufacturer's instructions.

2. Compact base courses at optimum moisture content to required grades, lines, cross sections and thickness to not less than 100 percent density in accordance with AASHTO T-180 as modified by NCDOT or to at least 98% of the nuclear target density as specified in section 520 of the NCDOT Standard Specifications for Roads and Structures.
3. Shape base course to required crown elevations and cross-slope grades.
4. When thickness of compacted base course is 6 inches or less, place materials in a single layer.
5. When thickness of compacted base course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick when compacted.
6. Following compaction testing and within 48 hours prior to the application of asphalt or concrete pavement, the aggregate base course shall be proofrolled with a fully loaded dual wheel tandem axle dump truck or similar construction equipment. Four passes shall be made in each orthogonal direction. The proofrolling operation shall be observed by the Architect or Owner's independent testing agency. Should any area fail to tighten up after proofrolling and continue to rut and/or pump, the base course shall be scarified and moistened or aerated and recompacted. Repeat proofroll testing.

- B. Pavement Shoulders: Place shoulders along edges of base course to prevent lateral movement. Construct shoulders at least 12 inches (300 mm) wide of acceptable soil materials and compact simultaneously with each base course layer.

3.19 FIELD QUALITY CONTROL

- A. Owner's Independent Testing Agency Services: Allow testing agency to evaluate and test each subgrade and each fill or backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.
1. Perform testing and evaluation of borrow or fill soils for compliance with material specifications of this Section.
 2. Perform field in-place density tests according to ASTM D 1556 (sand cone method), ASTM D6938 (nuclear gauge method) or equal as determined by the Owner's independent testing agency.
 3. Paved Areas (including courts and tracks): At subgrade and at each compacted fill, backfill layer, and aggregate base course layer, perform at least one field in-place density test for every 10,000 sq. ft. or less of paved area, but in no case fewer than three tests. Observe proofrolling of finished subgrade and aggregate base course.
 4. Trench Backfill: Perform at least one field in-place density test per 2 feet of backfill per 100 linear feet or less of trench outside of limits of buildings, but no fewer than two tests per trench per day.
 5. Pond Embankments: At subgrade and at each compacted fill and backfill layer, perform at least one field in-place density test for every 200 linear ft. or less of embankment, but in no case fewer than ten tests. Observe use of impervious fill as embankment materials. Perform evaluation of soils to be used as embankment fill for compliance with material specifications herein.

6. Non-Structural Areas: Field density and moisture content tests shall be performed on the fill and backfill at a rate of at least one test per every 15,000 square feet of area being filled.
 7. Pond/Wetland Imperviousness: At surface of empty pond soil surface, perform measurement of soil infiltration rate according to ASTM D 3385 at a rate of one test per each 3,000-sf of surface area.
 8. Observe proof-rolling and vibratory rolling operations as described herein.
 9. Refer to Special Inspections section below for testing within building limits.
- B. When testing agency reports that subgrades, fills, or backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, recompact and retest until required density is obtained. Contractor shall be responsible for all costs associated with re-testing required due to failed compaction.
- C. Proofrolling: Subgrade to receive fill, finish subgrade of building or pavement areas, and aggregate base courses shall be proofrolled with a fully loaded dual wheel tandem axle dump truck or similar construction equipment. Four passes shall be made in each orthogonal direction. The proofrolling operation shall be observed by the Owner's testing agency. Should any area fail to tighten up after proofrolling and continue to rut and/or pump, the soil shall be scarified and moistened or aerated and recompact. Repeat proofrolling operations.
- D. Pond and Wetland Imperviousness: Following completion of new permanent detention ponds or constructed wetlands, fill pond or wetland with water, measure and record water level every 24-hrs for a period of three days with no precipitation with time/date stamped photos. Provide water level measurements to Architect. Do not proceed with final planting until imperviousness is confirmed by Architect.

3.20 SPECIAL INSPECTIONS

- A. Allow Special Inspections and tests to be performed by the Special Inspector or Special Inspection Agency.
- B. Verification and inspection of earthwork construction shall be in accordance with Section 1705 of the North Carolina State Building Code 2018, and as follows:
1. Review laboratory test reports, certificates of compliance, or other data submitted to show compliance with specifications, and conduct field inspections and tests during earthwork operations as necessary to verify compliance with the contract documents.
 2. All site stripping and proofrolling operations shall be observed and monitored. Verify suitability of subgrade prior to installation of fill.
 3. At footing subgrades, test each soil stratum to verify design bearing capacities. Verification and approval of footing subgrades may be based on a comparison of subgrade with test data. Perform additional testing as necessary.
 4. Test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

- a. Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of building slab, but in no case fewer than three tests.
 - b. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 50 feet or less of wall length, but no fewer than two tests.
 - c. Trench Backfill in Building Areas: At each compacted initial and final backfill layer, at least one test for every 50 feet or less of trench length, but no fewer than two tests.
- C. Allow Special Inspector to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements
- D. When subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.
- E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- F. Additional testing performed to determine compliance of corrected work with specified requirements shall be at Contractor's expense.

3.21 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace material to depth directed by the Architect or Owner's independent testing agency; reshape and recompact at optimum moisture content to the required density.
- C. Settling: Where settling occurs during the Project correction period, remove finished surfacing, backfill with additional approved material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off the Owner's property.

END OF SECTION 31 20 00

SECTION 312500 - EROSION & SEDIMENT CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following: Soil erosion and sedimentation control for all areas of the site that are graded or disturbed by any construction operations and elsewhere as indicated on the Drawings or specified herein. Erosion control shall be as specified herein and as may be required by actual conditions and governing authorities.
- B. The Contractor is fully responsible for all applicable permits and approvals for off-site borrow and waste areas.
- C. The Contractor shall have full responsibility for the construction and maintenance of erosion control and sedimentation control facilities as shown on the Drawings and as specified herein. The Contractor shall at all times provide the operation and maintenance necessary to operate the permitted sediment and erosion controls at optimum efficiency.
- D. The Contractor shall provide permanent or temporary ground cover as soon as possible over disturbed areas of the site and shall provide permanent or temporary ground cover in no more than 14 days after construction activities have permanently or temporarily ceased over the disturbed area. Temporary or permanent ground cover shall be provided on slopes within 7 days after construction activities have permanently or temporarily ceased.
- E. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 31 Section "Site Clearing"
 - 2. Division 31 Section "Earth Moving"
 - 3. Division 32 Section "Planting"

1.3 PRODUCT HANDLING

- A. Deliver seed, fertilizer and other packaged materials in unopened original packages with labels legible and intact. Seed packages shall bear a guaranteed analysis by a recognized authority.
- B. On-site storage of materials shall be kept to a minimum. Wet or damaged seed or other material shall be removed from the project site immediately.

1.4 MONITORING AND RECORD KEEPING

- A. Contractor shall abide by all conditions of the General Permit to Discharge Stormwater under the National Pollutant Discharge Elimination System (NPDES), Permit No. NCG010000 (obtain copy from Owner) and the general requirements listed below. NPDES General Permit No. NCG01000 can be viewed at:

https://files.nc.gov/ncdeq/Energy%20Mineral%20and%20Land%20Resources/Stormwater/NCG010000_Final_Permit_2019_04_01.pdf

- B. All sediment and erosion control devices and facilities shall be inspected at least once every seven (7) calendar days and within 24 hours after any storm event of greater than 0.5 inches of rain per 24 hour period.
- C. Stormwater discharges shall be inspected by observation for stormwater discharge characteristics (as listed below) at the above frequency to evaluate the effectiveness of the sediment control facilities, devices or practices. Observations shall be made at all stormwater discharge outfalls and other locations where concentrated stormwater discharges from the site. Observations shall be qualitative, no analytical testing or sampling is required. If any visible off-site sedimentation is leaving the site, corrective action shall be taken to reduce the discharge of sediments.
 - 1. Color.
 - 2. Odor.
 - 3. Clarity.
 - 4. Floating solids.
 - 5. Suspended solids.
 - 6. Foam.
 - 7. Oil sheen.
 - 8. Other obvious indicators of stormwater pollution.
- D. The contractor shall perform and keep records of the above inspections. Visible sedimentation found off the site shall be recorded with a brief explanation as the measures taken to prevent future releases as well as any measures taken to clean up the sediment that has left the site. This record shall be made available to the Owner, Architect and governmental authorities.

PART 2 - PRODUCTS

2.1 SOIL AMENDMENTS AND SEED

- A. Refer to Division 32 Section "Planting".

2.2 MISCELLANEOUS

- A. Gravel for Stone Filters: Washed No. 57 stone or as indicated on the drawings.
- B. Silt Fence Fabric: A synthetic filter fabric or a pervious sheet of polypropylene, nylon, polyester, or polyethylene yarn, which is certified by the manufacturer or supplier as conforming to the following requirements.
 - 1. Tensile Strength (Grab): 90 x 90-lbs. min., ASTM D 4632.
 - 2. Permittivity: 0.05-sec⁻¹ min., ASTM D 4491.
 - 3. Apparent Opening Size: #30 US Sieve (0.60-mm) max., ASTM D 4751.
 - 4. UV Resistance (500-hrs): 70%, ASTM D 4355.
- C. Filter Fabric (for installation under riprap): Woven geotextile fabric, apparent opening size no larger than US Standard Sieve no. 70, min. grab strength of 120-lbs.

- D. Polyacrylamide (PAM) Turbidity Control Log: Soil specific tailored, solid form PAM product containing blends of water treatment components and polyacrylamide co-polymer for water clarification (25 NTU max. at outlet of sediment basin) and erosion control. Product shall be designed for site specific soil and water conditions. APS-700 Series Floc Log by Applied Polymer Systems, Inc. or approved equal.
- E. Dewatering Silt Bag: Permeable, non-woven geotextile bag manufactured to accept and filter pumped, sediment-laden water from dewatering activities. Silt bag shall be sized as appropriate for the dewatering pump discharge rate and shall be fitted with a fill spout large enough to accommodate the discharge piping of the dewatering pump. Silt bag shall be Dirtbag as manufactured by ACF Environmental, Inc. or approved equal.
- F. Compost Filter Sock: Three-dimensional tubular sediment control device comprised of an organic compost filter media contained in a tubular knitted mesh sock.
 - 1. Filter media shall be mature compost that has been certified by the US Composting Council's Seal of Testing Assurance Program and meeting the following specifications.
 - a. pH: 5.0 – 8.5.
 - b. Moisture Content: < 60%.
 - c. Organic Matter: >25%, dry weight.
 - d. Particle Size: 99% passing 2-in sieve, 30-50% passing 3/8-in sieve.
 - 2. Filter sock netting shall be 5-mm thick continuous HDPE filament, tubular knitted mesh with 3/8-in openings. Filled sock shall be a minimum of 12-in in diameter.
 - 3. Stakes shall be 2x2-in x 3-ft wooden stakes.

2.3 INLET PROTECTION MEASURES

- A. Manufactured Inlet Sediment Control Device: Storm drainage inlet sediment control device shall be manufactured from woven polypropylene geotextile to fit the opening of a catch basin or drop inlet to filter sediment from runoff entering the inlet. The device shall be a High Flow Siltsack as manufactured by ACF Environmental, Inc. or approved equal. Device shall be provided with an integral curb deflector if installed at a catch basin with a vertical opening adjacent to a horizontal grate.
- B. Floor Drain / Area Drain Sediment Filter Device: Small size storm drainage inlet sediment control device shall be manufactured from woven polypropylene geotextile to fit into small diameter floor drains to filter sediment from runoff entering the inlet. The device shall be a Round Drain Insert as manufactured by New Pig Corp. or approved equal.

2.4 CHANNEL AND SLOPE MATTING

- A. Channel Matting: Erosion Control blankets for installation in channels shall be a machine-produced mat of curled wood fiber (excelsior) or synthetic polypropylene fiber as specified below. The blanket shall be of consistent thickness with the fiber evenly distributed over the entire area of the mat. The blanket shall be covered with a photo degradable plastic netting secured to the fiber mat. Channel liners shall be excelsior mat unless otherwise indicated on the drawings.
 - 1. Excelsior Mat:

- a. Fiber: Curled wood excelsior of 80% six inch or longer fiber length with a consistent width of fibers evenly distributed throughout the mat. Mat shall be smolder resistant with no chemical additives.
 - b. Top and Bottom Netting: Photo degradable extruded plastic netting with maximum mesh size of $\frac{3}{4}$ " x $\frac{3}{4}$ ".
2. Wire Staples: 16 gauge steel wire, with minimum of 3" top and 6" long legs. 1.75 staples per square yard of matting minimum.
- B. Slope Matting: Erosion Control blankets for installation on slopes (not channels) shall be a machine-produced mat of crimped wood fiber and/or other degradable fibers manufactured without nets or threads. Staples or stakes used to secure the mat shall be wood or 100% biodegradable natural material. No nets or metal staples shall be used on any areas other than within channels.
1. Excelsior Mat:
- a. Fiber: Net-free, curled wood excelsior of 80% six inch or longer fiber length with a consistent width of fibers evenly distributed throughout the mat. Mat shall be smolder resistant with no chemical additives.
2. Stakes or Staples: Wood or 100% biodegradable natural material with additive to cause breakdown and 100% degradation within 24-36 months after installation.

2.5 RIPRAP

- A. Riprap: Provide riprap of the class and quantity indicated on the Drawings. While no specific gradation is required, the various sizes of the stone shall be equally distributed within the required size range. The size of an individual stone shall be determined by measuring its long dimension. Stone shall meet the requirements of the following table for class and size distribution. No more than 5% of the material furnished can be less than the minimum size specified nor no more than 10% of the material can exceed the maximum size specified.

REQUIRED STONE SIZES - INCHES			
CLASS	MINIMUM	MIDRANGE	MAXIMUM
A	2	4	6
B	5	8	12
1	5	10	17
2	9	14	23

PART 3 - EXECUTION

3.1 GENERAL

A. Existing Structures and Facilities

1. Existing structures, facilities, and water courses shall be protected from sedimentation.
2. The Contractor shall be responsible for the construction of necessary measures, and all costs shall be at the expense of the Contractor.

3. Items to be protected from sedimentation deposits shall include, but are not limited to, all downstream property, natural waterways, streams, lakes and ponds, catch basins, drainage ditches, road gutters, and natural buffer zones.
4. Control measures such as the erection of silt fences, barriers, dams, or other structures shall begin prior to any land disturbing activity. Additional measures shall be constructed as required during the construction.
5. All facilities installed shall be maintained continuously during construction until the disturbed areas are stabilized. Contractor shall remove all erosion control measures at the end of the project at his expense unless otherwise directed by the Owner or his representative.
6. Perform monitoring and record keeping as specified in this section.

3.2 PROTECTIVE MEASURES

- A. Protective measures shall conform to all State and Local requirements.
- B. Construction and maintenance of sediment and erosion control measures shall be in accordance with all applicable laws, codes, ordinances, rules and regulations.
 1. Silt Fence: Hog wire or wire mesh fastened to posts as recommended by the Manufacturer and covered with silt fabric.
 2. Berms and Diversion Ditches: These shall be graded channels with a supporting ridge on the lower side constructed across a sloping land surface. Diversion ditches and berms shall be planted in vegetative cover as soon as completed.
 3. Mulching: Mulching shall be used to prevent erosion and to hold soil and seed in place during the establishment of vegetation.
 4. **Matting: Temporary slope and channel matting shall be used for temporary stabilization during the establishment of seeded cover in all grassed ditches, channels, long slopes, and steep banks (6:1 or steeper) and additional areas as indicated on plans.** Matting shall be installed on any area on site as needed to provide temporary stabilization whether or not matting is indicated on the plan. Install as indicated or per manufacturer's instructions. The installation of matting may be waived by the Architect if surface stabilization is obtained by other methods within the appropriate and agreed time frames. If adequate stabilization is not obtained, the Contractor shall install matting where required at no additional cost to the Owner.
 5. Build Berm, Pits and Gravel Filter as shown on Drawings. Maintain during construction to keep erosion and sedimentation to a minimum. When it is necessary to remove berm, pits, and gravel, return area to required profiles and condition.
 6. Construction Entrances: Construct all entrances in accordance with plans. Maintain all ingress/egress points to prevent tracking of soil onto the Owner's, public or private roads. Any soil that is tracked onto the roads shall be removed immediately.
 7. Riprap: Stone shall be graded so that the smaller stones are uniformly distributed throughout the mass. Stone may be placed by mechanical methods, augmented by hand placing where necessary, provided that when the riprap is completed it forms a properly graded, dense, neat layer of stone.
 8. Manufactured Inlet Sediment Control Device: Install device in accordance with manufacturer's instructions and install a curb deflector if appropriate. Inspect device after each rain event and at intervals not exceeding two weeks during construction. Remove, empty, clean, and replace the device as needed during construction. Empty collected sediment in approved, protected location. Remove and dispose of device following full and permanent stabilization of the contributing drainage area.

9. PAM Turbidity Logs: At a minimum, install logs in drainage structures located immediately upstream of sediment basins and traps. Install additional logs in any other locations indicated on the drawings. Install per manufacturer's instructions. Check logs regularly and after every runoff producing rainfall and replace as needed throughout the duration of construction.
10. Dewatering Silt Bag: Install silt bag on an undisturbed slope so incoming water flows downhill through the bag without causing erosion. Remove and replace silt bag when device no longer drains efficiently due to accumulated sediment in bag. Empty bag within disturbed limits of the site protected by other sediment control measures.
11. Compost Filter Logs: Stake filter log every 10-ft. Drive stakes through the center of the log and 1-ft into the ground. If sock netting must be joined, fit beginning of the new sock over the end of the old sock, overlapping by 1-2 ft. Fill with compost and stake the joint.
12. Other Measures: Other methods of protecting existing structures and facilities, such as vegetative filter strips, diversions, rip-rap, baffle boards, and ditch checks used for reduction of sediment movement and erosion, may be used at the option of the Contractor when approved by the appropriate State or local authorities.

C. Provide the following, at a minimum, to prevent windblown dust.

1. Apply straw mulch and establish temporary or permanent ground cover on exposed soil where work is not being actively performed.
2. Cover or establish vegetative cover on stockpiles.
3. Apply water or other approved dust suppressant as needed to soil surfaces before they become excessively dry.
4. Sweep and collect soil that has been tracked onto paved surfaces.

3.3 STABILIZATION

- A. Permanently protect stabilized areas prior to the removal of protective devices.
- B. After the final establishment of permanent stabilization, remove temporary sediment control measures. Re-spread accumulated sediments as specified.
- C. Permanently stabilize all areas disturbed by the removal and re-spreading operations immediately.

3.4 TEMPORARY SEEDING

- A. In accordance with the schedule as detailed on the drawings.

3.5 PERMANENT SEEDING

- A. In accordance with the schedule as detailed on the drawings.

3.6 MULCHING AND MATTING

- A. Apply mulch or matting to retain soil and grass.
- B. Mulch areas with slope greater than 5% by spreading a light cover of mulch over seeded area at the rate of not less than 85 lbs. per 1000 sq. ft.

- C. Install temporary matting in all grassed ditches, channels, long slopes, and steep banks (6:1 or steeper) and additional areas indicated on plans or where extra protection from erosion is needed.

END OF SECTION 31 25 00

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SECTION 321216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes provisions for hot-mixed asphalt paving over prepared subbase.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Material Certificates signed by material producer and Contractor, certifying that each material item complies with or exceeds specified requirements of NCDOT "Standard Specifications for Roads and Structures".
- C. Job Mix Formula: Provide Geotechnical consultant with two copies of the proposed job mix formula at least ten days prior to beginning work. This formula shall be approved by NCDOT for the type of pavement specified.
- D. Recycled Content: 15% minimum.

1.4 SITE CONDITIONS

- A. Weather Limitations for Prime and Tack Coats: Apply prime and tack coats only when the surface to be treated is dry and when the atmospheric temperature measured at the location of paving operations away from artificial heat are in compliance with current NCDOT Standard Specifications for Roads and Structures. Do not apply tack coat when weather is foggy or rainy.
- B. Weather Limitations for Asphalt Courses: Apply hot-mixed asphalt surface, intermediate and base courses when surface and air temperatures are in compliance with current NCDOT Standard Specifications for Roads and Structures and when base is dry.
- C. Grade Control: Establish and maintain required lines and elevations.
- D. Traffic Control: Provide traffic control devices, lane closures, positive protection and/or any other warning or positive protection devices necessary for the safety of road users and pedestrians during construction.
 - 1. Traffic control shall be performed in conformance with the latest NCDOT Roadway Standard Drawings and Standard Specifications for Roads and Structures and the Manual on Uniform Traffic Control Devices for Streets and Highways.
 - 2. Sidewalk closures shall be installed as necessary. Pedestrian traffic shall be detoured around these closures and shall be signed appropriately and in accordance with ADA guidelines.

3. Two-way traffic shall be maintained at all times through use of flagmen when necessary.
4. Maintain access for fire-fighting equipment and access to fire hydrants.

1.5 QUALITY ASSURANCE

- A. All materials, construction methods and testing shall comply with the requirements of the latest editions of the North Carolina Department of Transportation (NCDOT) "Standard Specifications for Roads and Structures" and the Asphalt Handbook Manual Series No. 4 (MS-4).
- B. All work within any NCDOT right-of-way shall conform to the provisions and conditions of the NCDOT encroachment agreement(s) and driveway permit(s) and other applicable NCDOT standards and policies. The encroachment agreement(s) and driveway permit(s) are considered part of the project specifications by reference. Copies of the agreement(s) and permit(s) will be provided upon request from the Architect.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Use locally available materials and gradations that comply with the requirements of the NCDOT "Standard Specifications for Roads and Structures" and exhibit a satisfactory record of previous installations.
- B. Aggregate Base Course (ABC): Type A aggregate base course meeting the requirements of the latest version of NCDOT "Standard Specifications for Roads and Structures."
- C. Superpave Asphalt Paving Mix: Superpave base, intermediate and surface asphalt paving mix meeting the requirements of the latest version of NCDOT "Standard Specifications for Roads and Structures." Types as indicated on the drawings.
- D. Tack Coat: Asphalt material meeting the requirement of the latest version of NCDOT "Standard Specifications for Roads and Structures."
- E. Parking Lot Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than 45 minutes.
 1. Color: White for parking lot striping.
 2. Color: Yellow for fire lanes and service area striping.
- F. Roadway Pavement Marking Paint: Thermoplastic Alkyd/Maleic and Hydrocarbon type, meeting the requirements of Section 1087 of NCDOT "Standard Specifications for Roads and Structures."
 1. Color: As indicated on the drawings.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. General: Remove loose material from compacted subbase surface immediately before applying base courses of asphalt.
- B. Proof-roll prepared subgrade surface as described in Section “Earth Moving” to check for unstable areas and areas requiring additional compaction.
- C. Do not begin paving work until deficient subbase areas have been corrected and are ready to receive paving. Ensure subgrade is graded for proper drainage. Repair as needed to avoid ponding on final pavement surfaces.
- D. Cold mill surfaces of existing pavements in locations and to depths as indicated on the drawings and as follows.
 - 1. At edges of existing pavement to be overlaid: Cold mill surfaces of existing pavements to a minimum depth of 1.5-inches at longitudinal terminus of asphalt overlays for a minimum width of 10 feet (extend terminus milling width to 100-ft on public roads) and at horizontal terminus (including along gutter line of existing curbs adjacent to asphalt overlays) for a minimum width of 6 feet to allow a smooth transition from full-depth thickness of overlay course to existing pavement or gutter surface. Thoroughly remove all loose material from milled surface before placing tack coat.
 - 2. At pavement to be wedge overlaid: Cold mill surfaces of existing pavements to required depths at edges of asphalt wedge sections on public roads for widths needed to allow minimum depth thickness of wedge course. Thoroughly remove all loose material from milled surface before placing tack coat.
 - 3. At butt joint of new asphalt to existing asphalt: Cold mill surfaces of existing pavements to a minimum depth of 1.5-inches for a minimum width of 12-inches along length of new joint to allow new asphalt surface to be keyed-in to the existing pavement. Thoroughly remove all loose material from milled surface before placing tack coat.
- E. Thoroughly remove all dust and loose material from surfaces of that which the tack coat is to be applied along with adjacent surfaces before placing tack coat.
- F. Crack Filling: Remove debris from cracks or joints to a depth of 1/4 inch.
 - 1. Clean cracks and joints in existing asphalt pavement with compressed air.
 - 2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
 - 3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
- G. Apply tack coat to all contact surfaces of milled asphalt, existing asphalt to be overlaid, and surfaces abutting or projecting into hot-mixed asphalt pavement including the vertical face of adjacent concrete gutter. Distribute evenly and thoroughly at a rate of 0.04 to 0.08 gallons per sq. yd. of surface.
 - 1. Apply only as much tack coat as can be covered during the same day’s operation.
 - 2. Take necessary precautions to limit the tracking and/or accumulation of tack coat material on either existing or newly constructed pavements. Excessive accumulation of tack may require corrective measures.

3. Apply tack coat material with a distributor spray bar that can be adjusted to uniformly coat the entire surface at the directed rate. Use hand hose attachments only on irregular area and areas inaccessible to the spray bar. Cover these areas uniformly and completely.
 4. Apply tack coat to contact surfaces of gutters, concrete pavements, manholes, vertical faces of old pavements, and all exposed transverse and longitudinal edges of each course before mixture is placed adjacent to such surfaces.
 5. Cover curbs, adjacent concrete, and all other appurtenances to protect them from tracking or splattering tack coat material.
 6. Do not place any asphalt mixture until the tack coat has sufficiently cured.
- G. Allow to dry until at proper condition to receive paving.
- H. Exercise care in applying bituminous materials to avoid smearing of adjoining concrete surfaces. Remove and clean damaged surfaces.
- I. Place aggregate base courses as specified in Section "Earth Moving".

3.2 PATCHING

- A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd.
1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- C. Patching: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.3 REPAIRS

- A. Patching: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade. Install hot-mix asphalt pavement per the requirements of this section.
- B. Crack Filling: Remove debris from cracks or joints to a depth of 1/4 inch.
1. Clean cracks and joints in existing hot-mix asphalt pavement.
 2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
 3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

3.4 PLACING MIX

- A. Limitations: Do not produce or place asphalt mixtures during rainy weather, when the subgrade or base course is frozen, or when the moisture on the surface to be paved would prevent proper bond. Comply with all NCDOT weather and temperature limitations.
- B. General: Place hot-mixed asphalt mixture on prepared surface, spread, and strike off. Spread mixture at minimum temperature of 225 deg F. Place areas inaccessible to equipment by hand. Place each course to required grade, cross-section, and compacted thickness.
- C. Paver Placing: Place in strips not less than 10 feet wide, unless otherwise acceptable to Architect. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete base course for a section before placing surface course.
- D. Immediately correct surface irregularities in finish course behind paver. Remove excess material forming high spots with shovel or lute.
- E. Joints: Make joints between old and new pavements, or between successive days' work, to ensure continuous bond between adjoining work. Construct joints to have same texture, density, and smoothness as other sections of hot-mixed asphalt course. Clean contact surfaces and apply tack coat.

3.5 ROLLING

- A. General: Begin rolling when mixture will bear roller weight without excessive displacement.
- B. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.
- C. Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling and repair displaced areas by loosening and filling, if required, with hot material.
- D. Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been evenly compacted.
- E. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained required density. Compact the asphalt to at least the minimum percentage of the maximum specific gravity listed below unless otherwise allowed by NCDOT.
 - 1. SF-9.5A: 90.0% of Maximum Specific Gravity
 - 2. S-9.5B/C, I-19.0B/C, B-25.0B/C: 92.0% of Maximum Specific Gravity.
- F. Patching: Remove and replace paving areas mixed with foreign materials and defective areas. Cut out such areas and fill with fresh, hot hot-mixed asphalt. Compact by rolling to specified surface density and smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.6 TRAFFIC MARKINGS

- A. Cleaning: Sweep and clean surface to eliminate loose material and dust.
- B. Materials: Use thermoplastic marking for permanent markings on public streets and stop bars and crosswalks on private drives and parking lots. Use marking paint for parking and fire lane striping and other markings on private drives and parking lots.
- C. Apply traffic paint with mechanical equipment to produce uniform straight edges. Apply at manufacturer's recommended rates to provide minimum 12 to 15 mils dry thickness.
- D. Apply thermoplastic markings using application equipment constructed to assure continuous uniformity in the thickness and width of the thermoplastic pavement marking. Use equipment that provides multiple width settings ranging from 4 inches to 12 inches and multiple thickness settings to achieve the pavement marking thickness ranging from 0.090 inch to 0.120 inch. Comply with all applicable NCDOT standards
- E. Remove existing markings as indicated by water blasting.

3.7 FIELD QUALITY CONTROL

- A. General: Testing of asphalt concrete mix and in-place hot-mixed asphalt courses for compliance with requirements for thickness and surface smoothness will be done by Owner's testing laboratory in accordance with Division 1 Section "Quality Control." Repair or remove and replace unacceptable paving as directed by Architect.
 - 1. Testing agency will conduct and interpret tests and state in each report whether tested work complies with or deviates from the specified requirements.
- B. Thickness: In-place compacted thickness of each layer of asphalt shall be tested in accordance with ASTM D 3549. Results shall be considered unacceptable if the compacted thickness of any one core sample is greater than 1/2-inch below the thickness specified on the drawings or if the average thickness of all core samples is less than the thickness specified on the drawings.
- C. Surface Smoothness: Test finished surface of each hot-mixed asphalt course for smoothness, using 10 feet straightedge applied parallel with and at right angles to centerline of paved area. Surfaces will not be acceptable if exceeding the following tolerances for smoothness:
 - 1. Base Course Surface: 1/4 inch.
 - 2. Wearing Course Surface: 3/16 inch.
 - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.
- D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979 or AASHTO T 168.

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
 - a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
 - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
- E. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.
- F. Contractor shall repair all test core holes with full depth asphalt patch.
- G. Perform ponding water tests. Repair areas of pavement that pond water.
- H. Check surface areas at intervals as directed by Architect.

END OF SECTION 321216

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SECTION 321313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes exterior portland cement concrete paving for the following:
 - 1. Curbs and gutters, pavement, walkways.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 31 Section "Earth Moving" for subgrade preparation, grading and subbase course.
 - 2. Division 03 Section "Cast-in-Place Concrete" for general building applications of concrete.
 - 3. Division 07 Section "Sealants and Caulking" for joint fillers and sealants within concrete paving and at joints with adjacent construction.

1.3 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract and Division 01 Specification Sections.
- B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, joint systems, curing compounds, dry-shake finish materials, and others if requested by Architect.
- C. Design mixes for each class of concrete. Include percentage of recycled content (20% minimum). Include revised mix proportions when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
- D. Scaled plan of proposed construction, expansion and control joint locations in concrete pavement and concrete sidewalk. Submittal of plans for joints in curb and gutter or longitudinal sidewalk 6-feet or less in width is not required.

1.4 QUALITY ASSURANCE

- A. Concrete Standards: Comply with provisions of the following standards, except where more stringent requirements are indicated.
 - 1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
 - 2. ACI 318, "Building Code Requirements for Reinforced Concrete."
 - 3. ACI 330R, "Guide for the Design and Construction of Concrete Parking Lots."
 - 4. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."

- B. Concrete Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
- C. Concrete Testing Service: Engage a qualified independent testing agency to perform materials evaluation tests and to design concrete mixes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 - 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
 - 1. Use flexible or curved forms for curves with a radius 100 feet or less.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.
- C. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60, deformed bars; assembled with clips.
- D. Plain Steel Wire: ASTM A 82, as drawn.
- E. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs. Electroplated zinc steel plates, ASTM A 108, ASTM B633 with corresponding pocket former.
- F. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.
- G. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports

according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete, and as follows:

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use one of the following cementitious materials, of the same type, brand, and source throughout the Project:

1. Portland Cement: ASTM C 150, portland cement, Type I, II, or III.
 - a. Fly Ash: ASTM C 618, Class F. Up to 30% by weight of required cement content, with 1.0-lbs Fly Ash per 1-lb of cement replaced.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120 with 1-lb slag per 1-lb of cement replaced.

- B. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate, uniformly graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar pavement applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

- C. Water: ASTM C 94/C 94M, potable.

- D. Air-Entraining Admixture: ASTM C 260.

- E. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.5 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.

- D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
- E. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.6 RELATED MATERIALS

- A. Expansion and Isolation Joint Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Wheel Stops: Precast, air-entrained concrete; 2500-psi minimum compressive strength; approximately 6 inches high, 9 inches wide, and 84 inches long. Provide chamfered corners and drainage slots on underside and provide holes for dowel-anchoring to substrate.
 - 1. Dowels: Galvanized steel, diameter of $\frac{3}{4}$ inch, minimum length 10 inches.
- C. Bonding Agent: ASTM C 1059, Acrylic or styrene butadiene.
- D. Epoxy Adhesive: ASTM C 881, two-component material suitable for dry or damp surfaces. Provide material type, grade, and class to suit requirements.

2.7 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.
- B. Proportion mixtures to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 4000 psi, 3500 psi, or 3000 psi as indicated on the drawings.
 - 2. Maximum Water-Cementitious Materials Ratio at Point of Placement: As specified by NCDOT Standard Specifications for class of concrete indicated.
 - 3. Slump Limit: Maximum 3.5 inches for non-vibrated, maximum 4 inches for vibrated.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
 - 1. Air Content: 5-1/2 percent plus or minus 1.5 percent for 1-1/2-inch (38-mm) nominal maximum aggregate size.
 - 2. Air Content: 6 percent plus or minus 1.5 percent for 1-inch (25-mm) nominal maximum aggregate size.
 - 3. Air Content: 6 percent plus or minus 1.5 percent for 3/4-inch (19-mm) nominal maximum aggregate size.
- D. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use admixtures in concrete, as required, for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

- E. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements as follows:
 - 1. Fly Ash: 30 percent.
 - 2. Ground Granulated Blast-Furnace Slag: 50 percent.
 - 3. Combined Fly Ash, and Ground Granulated Blast-Furnace Slag: 50 percent, with fly ash not exceeding 20 percent.

2.8 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116. Furnish batch certificates for each batch discharged and used in the Work.
 - 1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
 - 1. For concrete mixes of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
 - 2. For concrete mixes larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
 - 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

2.9 JOINT SEALANTS

- A. Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.
- B. Round Backer Rod for Cold-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depths and pavement bottom-side adhesion of sealant.

2.10 PAVEMENT MARKINGS

- A. Parking Lot Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than 45 minutes and formulated for concrete surfaces.
 - 1. Color: As indicated on the drawings.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. Proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready

to receive paving. Ensure subgrade is graded for proper drainage. Repair as needed to avoid ponding on final pavement surfaces.

- B. Remove loose material from compacted subbase surface immediately before placing concrete.
- C. Herbicide Treatment: Apply chemical weed control agent in strict compliance with manufacturer's recommended dosages and application instructions. Apply to compacted, dry subbase.
- D. Place aggregate base courses as specified in Division 31 Section "Earth Moving".

3.2 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for paving to required lines, grades, and elevations. Install forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement. Set forms to ensure positive drainage and compliance with ADA and Building Code requirements.
- B. Check completed formwork and screeds for grade and alignment to following tolerances:
 - 1. Top of Forms: Not more than 1/8 inch in 10 feet.
 - 2. Vertical Face on Longitudinal Axis: Not more than 1/4 inch in 10 feet.
- C. Clean forms after each use and coat with form release agent as required to ensure separation from concrete without damage.

3.3 PLACING REINFORCEMENT

- A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars" for placing and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded wire fabric in lengths as long as practicable at mid depth of concrete. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.4 JOINTS

- A. General: Construct contraction, construction, and isolation joints true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to the centerline, unless indicated otherwise.
 - 1. When joining existing paving, place transverse joints to align with previously placed joints, unless indicated otherwise.

- B. Contraction Joints: Provide weakened-plane contraction joints, sectioning concrete into areas as indicated below unless shown otherwise on Drawings. Construct contraction joints for a depth equal to at least 1/3 of the concrete thickness, as follows:
1. Tooled Joints: Form contraction joints in fresh concrete by grooving and finishing each edge of joint with a radiused jointer tool.
 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into hardened concrete when cutting action will not tear, abrade, or otherwise damage surface and before development of random contraction cracks.
 3. Inserts: Form contraction joints by inserting premolded plastic, hardboard, or fiberboard strips into fresh concrete until top surface of strip is flush with paving surface. Radius each joint edge with a jointer tool. Carefully remove strips or caps of two-piece assemblies after concrete has hardened. Clean groove of loose debris.
 4. Spacing:
 - a. Concrete Pavement (4-in to 4.5-in thick slabs): Locate contraction joints at 10-ft max. intervals, each way in concrete pavement.
 - b. Concrete Pavement (5-in to 5.5-in thick slabs): Locate contraction joints at 12.5-ft max. intervals, each way in concrete pavement.
 - c. Concrete Pavement (6-in and greater thick slabs): Locate contraction joints at 15-ft max. intervals, each way in concrete pavement.
 - d. Sidewalk & Patios (4-in thick slabs): Locate contraction joints at 5-ft max. intervals, each way in concrete sidewalks/patios unless shown otherwise. Locate contraction joints in sidewalks less than 8-ft in width at 5-ft intervals across the walk. Locate contraction joints in sidewalks of 8-ft and greater width at 5-ft intervals across the walk and equally section the walk lengthwise with joints at 5-ft. max. intervals (example: an 8-ft wide walk shall have contraction joints at 5-ft. spacing across the walk and one joint dividing the walk lengthwise into two, equal 4-ft sections.)
 - e. Curbs or Curb & Gutter: Locate contraction joints at 10-ft max. intervals in concrete curbs or concrete curb and gutter.
 5. Dowels: Some concrete pavement applications in very heavy load locations (such as fire stations) require dowels at contraction joints. Refer to the drawings for specific details for such requirements.
- C. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than 1/2 hour, unless paving terminates at isolation joints.
1. Continue reinforcement across construction joints unless indicated otherwise. Do not continue reinforcement through sides of strip paving unless indicated.
 2. Provide tie bars at sides of paving strips where indicated.
 3. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.
- D. Isolation (expansion) Joints: Form isolation joints of preformed joint filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
1. General spacing: Locate additional expansion joints at the following intervals unless indicated otherwise on the drawings.

- a. Pavement (greater than 4-in thick slabs): None in addition to located specified above.
 - b. Sidewalks (4-in thick slabs): 30-ft each way.
 - c. Curbs or Curb & Gutter: 90-ft spacing.
 2. Extend joint fillers full width and depth of joint 1/2 inch below finished surface where joint sealant is indicated. Place top of joint filler flush with finished concrete surface when no joint sealant is required.
 3. Furnish joint fillers in one-piece lengths for full width being placed wherever possible. Where more than one length is required, lace or clip joint filler sections together.
 4. Protect top edge of joint filler during concrete placement with a metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- E. Dowel Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated
1. Use dowel sleeves or lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.
 2. Diamond Dowel System is acceptable in lieu of round dowels. Contractor to provide submittal information to Engineer for review/approval. Install per manufacturer recommendations.

3.5 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work. Ensure forms are set to ensure water will not pond on final surface.
- B. Remove snow, ice, or frost from base surface and reinforcing before placing concrete. Do not place concrete on surfaces that are frozen.
- C. Moisten base to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.
- D. Comply with requirements and with ACI 304R for measuring, mixing, transporting, and placing concrete.
- E. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- F. Form and pour concrete pavement with thickened edges along all edges that could be subject to vehicle wheel loads, do not abut a building or wall, or are not doveled to the adjacent pavement or structure.
- G. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- H. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete complying with ACI 309R.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcing, dowels, and joint devices.
- I. Screed paved surfaces with a straightedge and strike off. Use bull floats or darbies to form a smooth surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces prior to beginning finishing operations.
- J. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.
 1. Remove and replace portions of bottom layer of concrete that have been placed more than 15 minutes without being covered by top layer or use bonding agent if acceptable to Architect.
- K. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete.
 1. Spill Gutters: Form and install curb and gutter with gutter pans that spill at ¼" per foot slope away from the curb in the following locations. Do not install curb and gutter that will pond water.
 - a. Outside of the Public Right of Way: Provide spill gutter where curb and gutter is located adjacent to pavement surfaces that slope away from curb.
 - b. Within the Public Right of Way: Slope gutter per NCDOT Standard Drawing 846.01.
- L. Cold-Weather Placement: Comply with provisions of ACI 306R and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 1. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
 2. Do not use frozen materials or materials containing ice or snow.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.
- M. Hot-Weather Placement: Place concrete complying with ACI 305R and as specified when hot weather conditions exist.
 1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled or chopped ice may be used to

- control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
 3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.6 CONCRETE FINISHING

- A. Float Finish: Begin floating when bleed water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Finish surfaces to true planes within a tolerance of 1/4 inch in 10 feet as determined by a 10-foot-long straightedge placed anywhere on the surface in any direction. Cut down high spots and fill low spots to ensure positive drainage and eliminate ponding. Refloat surface immediately to a uniform granular texture.
 1. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across all site concrete sidewalk and pavement surfaces perpendicular to line of traffic to provide a uniform fine line texture finish.
- B. Final Tooling: Tool edges of paving, gutters, curbs, and joints formed in fresh concrete with a jointing tool to a radius of 1/4-inch unless indicated otherwise on the drawings. Repeat tooling of edges and joints after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.7 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with the recommendations of ACI 306R for cold weather protection and ACI 305R for hot weather protection during curing.
- B. Evaporation Control: In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before floating.
- C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- D. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
 1. Moisture Curing: Keep surfaces continuously moist for not less than 7 days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with a 12-inch lap over adjacent absorptive covers.

2. **Moisture-Retaining-Cover Curing:** Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. **Curing Compound:** Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.8 TRAFFIC MARKINGS

- A. **Cleaning:** Remove all oil, dust, grease, dirt, loose rust, and other foreign material to ensure adequate adhesion.
- B. **Surface Preparation:** Surfaces shall be cured, clean, dry and sound. Remove all peeling paint from existing surfaces. Concrete surfaces shall cure minimum 30 days. Concrete sealers or efflorescence of new concrete should be removed by extended weathering, etching or abrasive blasting.
- C. **Application Conditions:** 50° min., 90° maximum (air, surface, and materials) at least 5° above dew point. Relative humidity 85% maximum.
- D. **Tinting:** Mix colors per manufacturer's specification. Only mix like paints (do not mix latex with acrylic or interior paints with exterior paints) to achieve required colors.
- E. **Apply traffic paint with mechanical equipment to produce uniform straight edges. Apply at manufacturer's recommended rates to provide minimum 12 to 15 mils dry thickness.**

3.9 FIELD QUALITY CONTROL TESTING

- A. **The Owner shall employ an independent testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement in accordance with Division 01 Section "Quality Control" and as follows:**
 1. **When total quantity of a given class of concrete is less than 50 cu. yd., Architect may waive strength testing if adequate evidence of satisfactory strength is provided.**
 2. **When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.**
- B. **Testing Services:** Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 1. **Testing Frequency:** Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
 2. **Slump:** ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.
- C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within one week of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
- G. Concrete paving will be considered defective if it does not pass tests and inspections.
- H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- 3.10 REPAIRS AND PROTECTION
- A. Remove and replace concrete paving that is broken, damaged, or defective, or does not meet the requirements of this Section.
 - B. Drill test cores where directed by Architect when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to paving with epoxy adhesive.
 - C. Protect concrete from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

- D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep concrete paving not more than 2 days prior to date scheduled for Substantial Completion inspections.
- E. Remove and replace concrete paving or curb and gutter that ponds water.

END OF SECTION 321313

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SECTION 321400 - UNIT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Concrete pavers set in aggregate and mortar setting beds.
 - 2. Aluminum edge restraints.
 - 3. Cast-in-place concrete edge restraints.
- B. Related Requirements:
 - 1. Section 321313 "Concrete Paving" for concrete base under unit pavers and for cast-in-place concrete curbs and gutters serving as edge restraints for unit pavers.
 - 2. Section 321443 "Porous Unit Paving" for unit paving using grid pavers or pavers with openings between them.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For materials other than water and aggregates.
- B. Product Data: For the following:
 - 1. Pavers.
 - 2. Mortar and grout materials.
 - 3. Edge restraints.
- C. Sustainable Design Submittals:
 - 1. Recycled Content
 - 2. SRI Value
 - 3. Manufacturing Location Certification
- D. Sieve Analyses: For aggregate setting-bed materials, according to ASTM C 136.
- E. Samples for Initial Selection: For each type of unit paver indicated.

1. Joint materials involving color selection.
 2. Exposed edge restraints involving color selection.
- F. Samples for Verification: For full-size units of each type of unit paver indicated. Assemble no fewer than five Samples of each type of unit on suitable backing and grout joints. Include Samples of the following:
1. Joint materials.
 2. Exposed edge restraints.

1.5 INFORMATIONAL SUBMITTALS

- A. Adhesion and Compatibility Test Reports: From latex-additive manufacturer for mortar and grout containing latex additives.
- B. Material Certificates: For unit pavers. Include statements of material properties indicating compliance with requirements, including compliance with standards. Provide for each type and size of unit.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for unit pavers, indicating compliance with requirements.
 1. For solid interlocking paving units, include test data for freezing and thawing according to ASTM C 67.

1.6 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Submit to latex-additive manufacturer, for testing as indicated below, Samples of flooring materials that will contact or affect mortar and grout that contain latex additives.
 1. Use manufacturer's standard test methods to determine whether mortar and grout materials will obtain optimal adhesion with, and will be non-staining to, installed brick and other materials constituting brick flooring installation.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store pavers on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.

- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Store liquids in tightly closed containers protected from freezing.
- E. Store asphalt cement and other bituminous materials in tightly closed containers.

1.9 FIELD CONDITIONS

- A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.
- B. Weather Limitations for Mortar and Grout:
 - 1. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
 - 2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6. Provide artificial shade and windbreaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F (38 deg C) and higher.
 - a. When ambient temperature exceeds 100 deg F (38 deg C), or when wind velocity exceeds 8 mph (13 km/h) and ambient temperature exceeds 90 deg F (32 deg C), set pavers within 1 minute of spreading setting-bed mortar.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of unit paver, joint material, and setting material from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

2.2 CONCRETE PAVERS

- A. Concrete Pavers: Solid interlocking paving units complying with ASTM C 936/C 936M and resistant to freezing and thawing when tested according to ASTM C 67, made from normal-weight aggregates.
 - 1. Thickness: 2-3/8 inches (60 mm).
 - 2. Face Size: Blend of three sizes (Blend percentages per manufacturer)
 - a. 6 Width x 12 Length
 - b. 12 Width x 12 Length
 - c. 12 Width x 18 Length

3. Basis of Design: Belgard Origins Pavers
4. Pattern: Dimensions/Origins 12 Pattern A
5. Color: Ash
6. Texture: Slate

2.3 CURBS AND EDGE RESTRAINTS

- A. Aluminum Edge Restraints: Manufacturer's standard straight, 3/16-inch- (4.8-mm-) thick by 4-inch- (100-mm-) high and L-shaped, 3/16-inch- (4.8-mm-) thick by 2-1/4-inch- (57-mm-) high extruded-aluminum edging with loops pressed from face to receive stakes at 12 inches (300 mm) o.c. and aluminum stakes 12 inches (300 mm) long for each loop.
- B. Job-Built Concrete Edge Restraints: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mixed concrete with minimum 28-day compressive strength of 3000 psi (20 MPa).

2.4 ACCESSORIES

- A. Cork Joint Filler: Preformed strips complying with ASTM D 1752, Type II.
- B. Compressible Foam Filler: Preformed strips complying with ASTM D 1056, Grade 2A1.

2.5 AGGREGATE SETTING-BED MATERIALS

- A. Graded Aggregate for Subbase: Sound, crushed stone or gravel complying with ASTM D 2940/D 2940M, subbase material, requirements in Section 312000 "Earth Moving" for subbase material.
- B. Graded Aggregate for Base: Sound, crushed stone or gravel complying with ASTM D 2940/D 2940M, base material, requirements in Section 312000 "Earth Moving" for base course.
- C. Sand for Leveling Course: Sound, sharp, washed, natural sand or crushed stone complying with gradation requirements in ASTM C 33/C 33M for fine aggregate.
- D. Stone Screenings for Leveling Course: Sound stone screenings complying with ASTM D 448 for Size No. 10.
- E. Sand for Joints: Fine, sharp, washed, natural sand or crushed stone with 100 percent passing No. 16 (1.18-mm) sieve and no more than 10 percent passing No. 200 (0.075-mm) sieve.
 1. Provide sand of color needed to produce required joint color.
- F. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications; made from polyolefins or polyesters, with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 1. Survivability: Class 2, AASHTO M 288.
 2. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D 4751.

3. Permittivity: 0.02 per second, minimum; ASTM D 4491.
 4. UV Stability: 50 percent after 500 hours' exposure, ASTM D 4355.
- G. Drainage Geotextile: Nonwoven needle-punched geotextile fabric, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
1. Survivability: Class 2, AASHTO M 288.
 2. Apparent Opening Size: No. 40 (0.425-mm) sieve, maximum; ASTM D 4751.
 3. Permittivity: 0.5 per second, minimum; ASTM D 4491.
 4. UV Stability: 50 percent after 500 hours' exposure, ASTM D 4355.
- H. Herbicide: Commercial chemical for weed control, registered with the EPA. Provide in granular, liquid, or wettable powder form.

2.6 MORTAR SETTING-BED MATERIALS

- A. Portland Cement: ASTM C 150/C 150M, Type I or Type II.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Sand: ASTM C 144.
- D. Latex Additive: [Manufacturer's standard] [acrylic resin] [or] [styrene-butadiene-rubber] water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed, and not containing a retarder.
- E. Thin-Set Mortar for Bond Coat: Latex-portland cement mortar complying with ANSI A118.4.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
 2. Provide prepackaged, dry-mortar mix containing dry, dispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 3. Provide prepackaged, dry-mortar mix combined with [acrylic resin] [or] [styrene-butadiene-rubber] liquid-latex additive at Project site.
 4. Provide product that is approved by manufacturer for application thickness of 5/8 inch (16 mm).
- F. Water: Potable.
- G. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches (50.8 by 50.8 mm) by 0.062 inch (1.57 mm) in diameter; comply with ASTM A 185/A 185M and ASTM A 82/A 82M except for minimum wire size.

2.7 MORTAR AND GROUT MIXES

- A. General: Comply with referenced standards and with manufacturers' written instructions for mix proportions, mixing equipment, mixer speeds, mixing containers, mixing times, and other procedures needed to produce setting-bed and joint materials of uniform quality and with

optimal performance characteristics. Discard mortars and grout if they have reached their initial set before being used.

- B. Mortar-Bed Bond Coat: Mix neat cement and water to a creamy consistency.
- C. Portland Cement-Lime Setting-Bed Mortar: Type M complying with ASTM C 270, Proportion Specification.
- D. Latex-Modified, Portland Cement Setting-Bed Mortar: Proportion and mix portland cement, sand, and latex additive for setting bed to comply with written instructions of latex-additive manufacturer and as necessary to produce stiff mixture with a moist surface when bed is ready to receive pavers.
- E. Latex-Modified, Portland Cement Bond Coat: Proportion and mix portland cement, aggregate, and liquid latex for bond coat to comply with written instructions of liquid-latex manufacturer.
- F. Thinset Mortar Bond Coat: Proportion and mix according to manufacturer's written instructions.
- G. Job-Mixed Portland Cement Grout: Proportion and mix job-mixed portland cement and aggregate grout to match setting-bed mortar except omit hydrated lime and use enough water to produce a pourable mixture.
 - 1. Pigmented Grout: Select and proportion pigments with other ingredients to produce color required. Do not exceed pigment-to-cement ratio of 1 to 10, by weight.
 - 2. Colored-Aggregate Grout: Produce color required by combining colored aggregates with portland cement of selected color.
- H. Packaged Grout: Proportion and mix according to grout manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces indicated to receive unit paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Where unit paving is to be installed over waterproofing, examine waterproofing installation, with waterproofing Installer present, for protection from paving operations, including areas where waterproofing system is turned up or flashed against vertical surfaces.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove substances from concrete substrates that could impair mortar bond, including curing and sealing compounds, form oil, and laitance.
- B. Sweep concrete substrates to remove dirt, dust, debris, and loose particles.

- C. Proof-roll prepared subgrade according to requirements in Section 312000 "Earth Moving" to identify soft pockets and areas of excess yielding. Proceed with unit paver installation only after deficient subgrades have been corrected and are ready to receive subbase and base course for unit pavers.

3.3 INSTALLATION, GENERAL

- A. Do not use unit pavers with chips, cracks, voids, discolorations, or other defects that might be visible or cause staining in finished work.
- B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.
- C. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.
 - 1. For concrete pavers, a block splitter may be used.
- D. Handle protective-coated brick pavers to prevent coated surfaces from contacting backs or edges of other units. If, despite these precautions, coating does contact bonding surfaces of brick, remove coating from bonding surfaces before setting brick.
- E. Joint Pattern: As indicated.
- F. Pavers over Waterproofing: Exercise care in placing pavers and setting materials over waterproofing so protection materials are not displaced and waterproofing is not punctured or otherwise damaged. Carefully replace protection materials that become displaced and arrange for repair of damaged waterproofing before covering with paving.
 - 1. Provide joint filler at waterproofing that is turned up on vertical surfaces unless otherwise indicated; where unfilled joints are indicated, provide temporary filler or protection until paver installation is complete.
- G. Tolerances: Do not exceed 1/32-inch (0.8-mm) unit-to-unit offset from flush (lippage) or 1/8 inch in 10 feet (3 mm in 3 m) from level, or indicated slope, for finished surface of paving.
- H. Tolerances: Do not exceed 1/16-inch (1.6-mm) unit-to-unit offset from flush (lippage) nor 1/8 inch in 24 inches (3 mm in 600 mm) and 1/4 inch in 10 feet (6 mm in 3 m) from level, or indicated slope, for finished surface of paving.
- I. Expansion and Control Joints: Provide for sealant-filled joints at locations and of widths indicated. Provide compressible foam filler as backing for sealant-filled joints unless otherwise indicated; where unfilled joints are indicated, provide temporary filler until paver installation is complete. Install joint filler before setting pavers. Sealant materials and installation are specified in Section 079200 "Joint Sealants."
- J. Expansion and Control Joints: Provide cork joint filler at locations and of widths indicated. Install joint filler before setting pavers. Make top of joint filler flush with top of pavers.

- K. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.
 - 1. Install edge restraints to comply with manufacturer's written instructions. Install stakes at intervals required to hold edge restraints in place during and after unit paver installation.
 - 2. For metal edge restraints with top edge exposed, drive stakes at least 1 inch (25 mm) below top edge.
 - 3. Install job-built concrete edge restraints to comply with requirements in Section 033000 "Cast-in-Place Concrete."
 - 4. Where pavers set in mortar bed are indicated as edge restraints for pavers set in aggregate setting bed, install pavers set in mortar and allow mortar to cure before placing aggregate setting bed and remainder of pavers. Cut off mortar bed at a steep angle so it will not interfere with aggregate setting bed.
 - 5. Where pavers embedded in concrete are indicated as edge restraints for pavers set in aggregate setting bed, install pavers embedded in concrete and allow concrete to cure before placing aggregate setting bed and remainder of pavers. Hold top of concrete below aggregate setting bed.
- L. Provide steps made of pavers as indicated. Install paver steps before installing adjacent pavers.
 - 1. Where pavers set in mortar bed are indicated for steps constructed adjacent to pavers set in aggregate setting bed, install steps and allow mortar to cure before placing aggregate setting bed and remainder of pavers. Cut off mortar bed at a steep angle so it will not interfere with aggregate setting bed.

3.4 AGGREGATE SETTING-BED APPLICATIONS

- A. Compact soil subgrade uniformly to at least 100 percent of ASTM D 1557 laboratory density.
- B. Proof-roll prepared subgrade to identify soft pockets and areas of excess yielding. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- C. Place separation geotextile over prepared subgrade, overlapping ends and edges at least 12 inches (300 mm).
- D. Place aggregate subbase and base, compact to 100 percent of ASTM D 1557 maximum laboratory density, and screed to depth indicated.
- E. Place drainage geotextile over compacted base course, overlapping ends and edges at least 12 inches (300 mm).
- F. Place leveling course and screed to a thickness of 1 to 1-1/2 inches (25 to 38 mm), taking care that moisture content remains constant and density is loose and uniform until pavers are set and compacted.
- G. Treat leveling course with herbicide to inhibit growth of grass and weeds.
- H. Set pavers with a minimum joint width of 1/16 inch (1.5 mm) and a maximum of 1/8 inch (3 mm), being careful not to disturb leveling base. If pavers have spacer bars, place pavers hand

tight against spacer bars. Use string lines to keep straight lines. Fill gaps between units that exceed 3/8 inch (10 mm) with pieces cut to fit from full-size unit pavers.

1. When installation is performed with mechanical equipment, use only unit pavers with spacer bars on sides of each unit.
-
- I. Vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf (16- to 22-kN) compaction force at 80 to 90 Hz. Use vibrator with neoprene mat on face of plate or other means as needed to prevent cracking and chipping of pavers. Perform at least three passes across paving with vibrator.
 1. Compact pavers when there is sufficient surface to accommodate operation of vibrator, leaving at least 36 inches (900 mm) of uncompacted pavers adjacent to temporary edges.
 2. Before ending each day's work, compact installed concrete pavers except for 36-inch (900-mm) width of uncompacted pavers adjacent to temporary edges (laying faces).
 3. As work progresses to perimeter of installation, compact installed pavers that are adjacent to permanent edges unless they are within 36 inches (90 mm) of laying face.
 4. Before ending each day's work and when rain interrupts work, cover pavers that have not been compacted and cover leveling course on which pavers have not been placed with nonstaining plastic sheets to protect them from rain.
 - J. Spread dry sand and fill joints immediately after vibrating pavers into leveling course. Vibrate pavers and add sand until joints are completely filled, then remove excess sand. Leave a slight surplus of sand on the surface for joint filling.
 - K. Do not allow traffic on installed pavers until sand has been vibrated into joints.
 - L. Repeat joint-filling process 30 days later.

3.5 MORTAR SETTING-BED APPLICATIONS

- A. Saturate concrete subbase with clean water several hours before placing setting bed. Remove surface water about one hour before placing setting bed.
- B. Apply mortar-bed bond coat over surface of concrete subbase about 15 minutes before placing mortar bed. Do not exceed 1/16-inch (1.6-mm) thickness for bond coat. Limit area of bond coat to avoid its drying out before placing setting bed.
- C. Apply mortar bed over bond coat; spread and screed mortar bed to uniform thickness at subgrade elevations required for accurate setting of pavers to finished grades indicated.
- D. Place reinforcing wire over concrete subbase, lapped at joints by at least one full mesh and supported so mesh becomes embedded in the middle of mortar bed. Hold edges back from vertical surfaces approximately 1/2 inch (13 mm).
- E. Place mortar bed with reinforcing wire fully embedded in middle of mortar bed. Spread and screed mortar bed to uniform thickness at subgrade elevations required for accurate setting of pavers to finished grades indicated.

- F. Mix and place only that amount of mortar bed that can be covered with pavers before initial set. Before placing pavers, cut back, bevel edge, and remove and discard setting-bed material that has reached initial set.
- G. Wet brick pavers before laying if the initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested according to ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.
- H. Place pavers before initial set of cement occurs. Immediately before placing pavers on mortar bed, apply uniform 1/16-inch- (1.5-mm-) thick bond coat to mortar bed or to back of each paver with a flat trowel.
- I. Tamp or beat pavers with a wooden block or rubber mallet to obtain full contact with setting bed and to bring finished surfaces within indicated tolerances. Set each paver in a single operation before initial set of mortar; do not return to areas already set or disturb pavers for purposes of realigning finished surfaces or adjusting joints.
- J. Spaced Joint Widths: Provide 3/8-inch (10-mm) nominal joint width with variations not exceeding plus or minus 1/16 inch (1.5 mm).
- K. Grouted Joints: Grout paver joints complying with ANSI A108.10.
- L. Grout joints as soon as possible after initial set of setting bed.
 - 1. Force grout into joints, taking care not to smear grout on adjoining surfaces.
 - 2. Clean pavers as grouting progresses by dry brushing or rubbing with dry burlap to remove smears before tooling joints.
 - 3. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
 - 4. If tooling squeezes grout from joints, remove excess grout and smears by dry brushing or rubbing with dry burlap and tool joints again to produce a uniform appearance.
- M. Cure grout by maintaining in a damp condition for seven days unless otherwise recommended by grout or liquid-latex manufacturer.

3.6 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.
- B. Pointing: During tooling of joints, enlarge voids or holes and completely fill with grout. Point joints at sealant joints to provide a neat, uniform appearance, properly prepared for sealant application.
- C. Cleaning: Remove excess grout from exposed paver surfaces; wash and scrub clean.
 - 1. Remove temporary protective coating as recommended by coating manufacturer and as acceptable to paver and grout manufacturers.

2. Do not allow protective coating to enter floor drains. Trap, collect, and remove coating material.

END OF SECTION 321400

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SECTION 324000 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Trash and Recycling Receptacles.

1.2 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Samples: For each type of exposed finish and for each color and texture required.
- C. Material Certificates: For the following:
 - 1. Recycled content.
 - 2. Manufactured location.
- D. Warranty
- E. Maintenance data.

PART 2 - PRODUCTS

2.1 TRASH AND RECYCLING RECEPTACLES

- A. Products:
 - 1. Exterior, commercial grade litter and recycling receptacles. Maglin Site Furniture (800) 716-5506. www.maglin.com, andrew.coen@maglin.com or krista.witte@maglin.com : Model MTR-0650-00005 – 650 Trash Containers or approved equal from one of the following:
 - a. Landscape Forms
 - b. Anova Site Furniture
 - c. Forms + Surfaces
- B. Pattern:
 - 1. Birch Pattern Laser Cut
- C. Size:
 - 1. 32 Gallon
- D. Color:
 - 1. To be selected by Landscape Architect. Contractor to submit standard color chart.
- E. Decal:
 - 1. Recycle: Recycle graphics digitally printed on a pressure sensitive vinyl decal.
 - a. Decal Material Color: Blue
 - b. Letter Color: White

c. Lid Color: Blue

F. Quantity:

1. See Plans.

G. Installation Method:

1. Surface mount

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Complete field assembly of site and street furnishings, where required.
- B. Unless otherwise indicated, install site and street furnishings after landscaping and paving have been completed.
- C. Install site and street furnishings level, plumb, true, and securely positioned at locations indicated on Drawings in accordance with manufacturer's printed instructions.

END OF SECTION 324000

SECTION 329000 PLANTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

1. Trees.
2. Shrubs.
3. Seeded lawns, sod and “no-mow” areas.
4. Topsoil and soil amendments.
5. Fertilizers and mulches.
6. Stakes and guys.
7. Landscape edging.
8. Maintenance, guarantees and warranties.

- B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 31, Section "Site Clearing" for protection of existing trees and planting, topsoil stripping and stockpiling, and site clearing.
2. Division 31, Section "Earth Moving" for excavation, filling, rough grading, and subsurface aggregate drainage and drainage backfill.
3. Division 31 Section “Erosion Controls” soil erosion and sedimentation control.

1.3 INDUSTRY STANDARDS

- A. References: Some products and execution are specified in this Section by reference to published specifications or standards of the following:

The American Society for Testing and Materials (ASTM)
American Association of Nurserymen (AAN)
US Department of Agriculture (USDA)
NC Department of Agriculture (NCDA)
NC Composting Council (NCCC)

- B. Landscape Contractor shall mean a registered “Landscape Contractor” as defined by the NC General Statute 89D (www.ncclcb.com). Unless proper credentials and evidence of experience can be supplied to prove equal capabilities, only a Landscape Contractor licensed in the State of NC shall be permitted to perform the work.

1. The Landscape Contractor’s performance shall conform to the requirements in the most current edition of the NC Landscape Contractors Manual (NCLCM) as approved by the NC Board of Landscape Contractors. In the event the Landscape Contractor feels there is discrepancy between the NCLCM and the requirements of this Contract that could affect

the quality of work; it is the Contractor's responsibility to apprise the Owner and Landscape Architect of the issue.

1.4 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 01 Specification Sections.
- B. Product certificates signed by manufacturers certifying that their products comply with specified requirements.
 - 1. Manufacturer's certified analysis for standard products.
 - 2. Label data substantiating that plants, trees, shrubs, and planting materials comply with specified requirements.
- C. Certification of grass seed from seed vendor for each grass-seed mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
- D. Samples of each of the following:
 - 1 Sample of imported mulch (1) 1-gal. sized bag.
 - 2 Topsoil (1) 1-gal sized bag.
- E. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, at least fifteen names and address of architects and owners, total years of experience and landscape contractor's license number. If the landscape contractor hires a sub-contractor for seeding operations, the same references shall be required from them also.
- F. Material test reports from qualified independent testing agency indicating and interpreting test results relative to compliance of the following materials with requirements indicated.
 - 1. Analysis of existing topsoil and suitability as a medium for growing specified lawn. Include recommendations of amendments required to make existing topsoil suitable as a growing medium for specified lawn, if required.
 - 2. Analysis of imported topsoil, if required due to unacceptability of existing topsoil to meet acceptable growing medium requirements for lawn.
- G. Planting schedule indicating anticipated dates and locations for each type of planting.
- H. Maintenance instructions recommending procedures to be established by Owner for maintenance of landscaping during an entire year. Submit before expiration of required maintenance periods.
- I. Landscape plant schedule, per Article 1.4, A, C, indicating quantity, botanical name, common name, specified size and vendor source for each individual plant species; including any substitutions. Include all cultivars and varieties for substitutions. Provide vendor source contact information as attachment to schedule.

CLH Design and the Owner reserve the right to reject any substitution requests and may request that the landscape contractor provide additional vendor search information and/or complete documentation to prove a hardship, to confirm reason(s) for substitution or to prove that the material is not available from local and national nurseries.

Refer to section 1.6, C for information regarding the appropriate time to dig trees. It is the Contractor's responsibility to plan ahead of time rather than waiting and checking availability at the time of installation.

- J. All sod shall be from a certified sod producer and be blue tag certified in accordance with NCCIA and AOSCA.

1.5 QUALITY ASSURANCE

- A. **Installer Qualifications:** Engage an experienced Installer who has completed landscaping work similar in material, design, and extent to that indicated for this Project and with a record of successful landscape establishment.
 - 1. **Installer's Field Supervision:** Require Installer to maintain an experienced full-time supervisor on the Project site during times that landscaping is in progress.
- B. **Testing Agency Qualifications:** To qualify for acceptance, an independent testing agency must demonstrate to Architect's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM E 699, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.
- C. **Provide quality, size, genus, species, and variety of trees and shrubs indicated, complying with applicable requirements of ANSI Z60.1 "American Standard for Nursery Stock."**
 - 1. Contractor shall show proof of cultivar authenticity to Landscape Architect. When cultivars are specified, standard species will not be acceptable.
- D. **Topsoil Analysis:** Furnish a soil analysis made by a qualified independent soil-testing agency stating percentages of organic matter, inorganic matter (silt, clay, and sand), deleterious material, pH, and mineral and plant-nutrient content of topsoil.
 - 1. Report suitability of on-site topsoil for growth of applicable planting material. State recommended quantities of nitrogen, phosphorus, and potash nutrients and any limestone, aluminum sulfate, or other soil amendments to be added to produce a satisfactory topsoil at no additional cost to owner.
- E. **Measurements:** Measure trees and shrubs according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches (150 mm) above ground for trees up to 4-inch (100-mm) caliper size, and 12 inches (300 mm) above ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.

When size ranges are given, 50 % of plant material shall be at the larger size.

- F. **Preinstallation Conference:** Conduct conference at Project site to comply with requirements of Division 01 Section "Project Meetings."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.
- B. Seed: Deliver seed in original sealed, labeled, and undamaged containers.
- C. Trees and Shrubs: Deliver freshly dug trees and shrubs. Do not prune before delivery, except as approved by Landscape Architect. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy natural shape. Provide protective covering during delivery. Do not drop trees and shrubs during delivery. For trees which cannot be dug in the summer, Contractor shall have trees pre-dug and heeled-in at the nursery where they are grown until planting. Contractor shall be responsible for ensuring that the trees have been adequately watered and cared for at the nursery prior to delivery. No substitutions will be allowed for trees which cannot be "summer-dug".
- D. Handle balled and burlap stock by the root ball.
- E. Deliver trees, shrubs, and ground covers after preparations for planting have been completed and install immediately. If planting is delayed more than 6 hours after delivery, set planting materials in shade, protect from weather and mechanical damage, and keep roots moist.

PLANT MATERIAL SHALL NOT BE DELIVERED TO THE SITE MORE THAN 72 HOURS BEFORE PLANTING TAKES PLACE. THE LANDSCAPE ARCHITECT RESERVES THE RIGHT TO REJECT ALL MATERIAL NOT PLANTED WITHIN THAT TIME PERIOD UNLESS THE LANDSCAPE CONTRACTOR MAKES HEELING-IN AND IRRIGATION PROVISIONS WITHIN 24 HOURS OF PLANT DELIVERY.

- 1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
- 2. Do not remove container-grown stock from containers before time of planting.
- 3. Water root systems of trees and shrubs stored on site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.

1.7 PROJECT CONDITIONS

- A. Utilities: Determine location of above grade and underground utilities and perform work in a manner which will avoid damage. Hand excavate, as required. Maintain grade stakes until removal is mutually agreed upon by parties concerned.
- B. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Landscape Architect before planting.

1.8 COORDINATION AND SCHEDULING

- A. Coordinate installation of planting materials during normal planting seasons for each type of plant material required.

Planting Season: The normal season for planting balled and burlap material is November 15 through March 15. The normal season for planting container grown material is September 15 through April 15. After notification to proceed, planting operations shall be conducted under favorable weather conditions during the normal planting season. The Landscape Contractor shall make provisions for watering the material on an as-needed basis and as frequently as is required to ensure that plant material thrives.

The General Contractor shall coordinate the planting schedule with the Landscape Contractor to avoid any summer digging and planting.

The Landscape Architect shall be notified and must approve of any schedule changes which may require summer planting. THE CONTRACTOR SHALL NOT BE COMPENSATED FOR ADDITIONAL WATERING COSTS FOR PLANTINGS WHICH ARE INSTALLED IN THE SUMMER.

- B. Temporary Seeding: In accordance with the schedule as detailed on the drawings.
 - 1. In the event the Landscape Contractor is required to establish a temporary seeding cover due to the construction schedule, the Landscape Contractor is not relieved from providing the specified permanent seed mixture.
 - 2. The Landscape Contractor is responsible for eradicating any temporary seed cover by means of mowing, thatching and using an herbicide approved by the Owner's representative at the manufacturer's recommended rate.

1.9 GRASS ESTABLISHMENT SCHEDULE

- A. Refer to the Supplementary Conditions for Final Completion dates of grassed areas of the site.
- B. Definitions:
 - 1. Final Complete seeded or sprigged grass: A healthy, dense, weed free stand of the specified species of grass with 95% grass coverage as evaluated on a per square yard sample basis.
 - 2. Final Complete sodded grass: An installed and rolled healthy sod, free of weeds and dead spots.
- C. Complete Site: A complete installation of grass sod and/or stand of grass, germinated from seed or sprigs, on the complete site shall be established by the following date:
 - 1. Complete Site (Seed, Sprig or Sod) Final Completion: *See Final Completion Date noted in contract documents.* Due to seasonal restrictions the specified date shall not be extended. Extension to the Contract Time will not change this date.

1.10 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

- B. Special Warranty: Contractor is responsible for general maintenance and care during warranty period. Contractor agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Death and unsatisfactory growth; except for defects resulting from abuse or incidents that are beyond Contractor's control.
 - b. Structural failures including plantings falling or blowing over.
 - 2. Warranty Periods from Date of Final Completion:
 - a. Trees, Shrubs, Ornamental Grasses, and Stormwater Control Measure Plants: 12 months.
 - b. Lawn, grass and sod (herbicide and fertilizer): 12 months
 - 3. Include the following remedial actions as a minimum:
 - a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
 - b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
 - c. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.
 - d. Provide extended warranty for period equal to original warranty period, for replaced plant material.
 - 4. Areas seeded or sodded that are bare and not established at the end of the warranty period shall be re-seeded or re-sodded at no additional cost to the Owner.
 - 5. Contractor is responsible for applying weed control herbicide and fertilizers during warranty period.

1.11 TREE AND SHRUB MAINTENANCE

- A. Maintain trees and shrubs by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray as required to keep trees and shrubs free of insects and disease. The presence of significant insects or disease at the end of warranty period shall be grounds for rejection of material. Restore or replace damaged tree wrappings. Maintain trees and shrubs until end of warranty period. At the end of the warranty period, Contractor is responsible for refreshing and/or reinstalling mulch for any areas that are bare and/or have less than 1-in mulch depth.

1.12 LAWN/GRASS MAINTENANCE

- A. Begin maintenance of lawns and other grassed areas immediately after each area is planted and continue until acceptable lawn is established and accepted by the Owner, but for not less than the following periods:
 - 1. Seeded Lawns/Grass and Naturalized Seed Areas: **Final Completion.**

- a. When full maintenance period has not elapsed before end of planting/growing season, or if lawn is not fully established at that time (95% coverage as established on a per square yard sample basis), continue maintenance during next planting season until 95% coverage is established.
 2. Sodded Lawns/Grass: **Final Completion.**
 - a. Sodded areas will be accepted at final inspection if –
 1. Sodded areas are properly established.
 2. Sod is free of bare and dead spots and without weeds.
 3. Sodded areas have been mowed a minimum of twice.
 - B. Maintain and establish lawns by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and re-mulch to produce a uniformly smooth lawn.
 - C. Watering: Provide and maintain temporary piping, hoses, and lawn-watering equipment to convey water from sources and to keep lawns uniformly moist to a depth of 4 inches (100 mm). Following the date of project Final Completion, water from irrigation may be obtained from the site water system.
 1. Supplement natural precipitation to provide a net rate of one inch of water per week or as required to maintain lawn in a thriving condition.
 2. Watering shall conform to the time, volume and frequency recommendations of applicable governmental water conservation regulations.
 3. Irrigate at minimum rate of once per day for two full weeks following date of seeding or sod installation.
 4. Irrigate at minimum of once per week for remainder of maintenance period.
 - D. Mow lawns as soon as there is enough top growth to cut with mower set at specified height for principal species planted. Repeat mowing as required to maintain specified height without cutting more than 40 percent of the grass height at any mowing. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet.
 - E. Postfertilization: Apply fertilizer to lawn after first mowing and when grass is dry. Apply only from August through October.
 1. Use fertilizer that will provide actual nitrogen of at least 1 lb per 1000 sq. ft. (0.5 kg per 100 sq. m) of lawn area or as required to maintain lawn in a thriving condition. A minimum of 50% of the nitrogen shall be in a slow release form.
- 1.13 STORMWATER CONTROL MEASURE MAINTENANCE
- A. Begin maintenance of stormwater control measures (stormwater wetlands, detention ponds and bioretention cells) immediately after each area is planted and continue until completion of the 12-month warranty period.

- B. The area to be maintained shall include the wet and dry surfaces of the facility and perimeter areas within 15-ft of the water quality pool elevation, along with the inlet and outlet structures, embankments, emergency spillway, turf and plants.
 - 1. Maintenance shall include all items listed in the Operation & Maintenance Plan listed on the drawings. Maintenance shall include, but not limited to, the following:
 - a. Keep dry and wet areas clean of trash and debris.
 - b. Repair of erosion. Re-seed any bare areas including top and slopes of embankments.
 - c. Keep inlet and outlet pipes, weirs, orifices, under-drains, and swales clear of blockages.
 - d. Remove accumulated sediment from riprap aprons.
 - e. Remove accumulated sediment forebay of wetlands and ponds if greater than 12-in of accumulation.
 - f. Prune shelf plants.
 - g. Remove invasive plants and algae.
 - h. Replace dead plants.
 - i. Replace/replenish mulch.
 - j. Other requirements of the Operation and Maintenance Plan on the drawings.
 - 2. Perform inspections at least every two months and after every storm of greater than 1.5-in of rainfall. Perform maintenance as needed.
 - 3. Final maintenance shall be performed immediately prior to the 11-month inspection.
 - 4. Perform additional maintenance and repair resulting from the 11-month inspection.
 - 5. Records of inspections and maintenance performed shall documented and supplied to the Owner at the completion of the warranty and maintenance period.

PART 2 - PRODUCTS

2.1 TREE AND SHRUB MATERIAL

- A. General: Furnish nursery-grown trees and shrubs conforming to ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement, including trunks which are not straight on single stem trees.
- B. The natural stem/root collar of balled and burlap materials shall be found within two inches of the nursery maintained soil line. Trees shall not be accepted which have been grown too deeply or too high in the soil profile.
- C. Grade: Provide trees and shrubs of sizes and grades conforming to ANSI Z60.1 for type of trees and shrubs required. Trees and shrubs of a larger size may be used if acceptable to Landscape Architect, with a proportionate increase in size of roots or balls.
- D. Label one tree and shrub in each plant grouping with securely attached, waterproof tag bearing legible designation of botanical and common name. Proof of cultivar shall be required on all species for which a cultivar is designated.
- E. Label at least 1 tree and 1 shrub of each variety and caliper with a securely attached, waterproof tag bearing legible designation of botanical and common name.

- F. Imported Fire Ant Control: All plants shall be accompanied by a certificate stating: “certified under all applicable state and federal quarantine.” Contact Landscape Architect for inspection of all plant materials for the presence of imported fire ants. The presence of fire ants shall be cause for rejection of plant material.

2.2 SHADE AND FLOWERING TREES

- A. Shade Trees: Single-stem trees with straight trunk, free of basal sprouts, well-balanced crown, and intact leader, of height and caliper indicated, conforming to ANSI Z60.1 for type of trees required. Grounds for rejection may include, but not limited to: improper branch density or distribution, “v” crotches, including bark, undesirable multiple leaders, leaders that have been topped or headed back, prevalent suckering or epicormic sprouting. Trees which have evidence of unevenly distributed, girdling or suckering roots may be rejected.

- 1. Branching Height: 1/2 of tree height.

- B. Small Trees: Small upright or spreading type, branched or pruned naturally according to species and type, and with relationship of caliper, height, and branching recommended by ANSI Z60.1, and stem form as specified in the Plant List on the drawings. Good structure shall be especially critical for trees. Grounds for rejection may include, but not limited to: improper branch density or distribution, “v” crotches, including bark, undesirable multiple leaders, leaders that have been topped or headed back, prevalent suckering or epicormic sprouting. Trees which have evidence of unevenly distributed, girdling or suckering roots may be rejected.

- C. Provide balled and burlap trees unless noted otherwise on the drawings. Plants designated “B&B” in the plant list shall be balled and burlap. They shall be nursery grown and freshly dug. They shall be dug with firm, natural balls of earth of sufficient diameter and depth to encompass the fibrous and feeding root system necessary for full recovery of the plant. Balls shall be firmly wrapped with untreated biodegradable burlap and bound with twine, cord, or wire mesh basket. Plants shall not be accepted if the ball is dry, deformed or broken before or during the planting operations.

2.3 DECIDUOUS SHRUBS

- A. Form and Size: Deciduous shrubs with not less than the minimum number of canes required by and measured according to ANSI Z60.1 for type, shape, and height of shrub.
- B. Provide container grown shrubs unless noted otherwise on the drawings.

2.4 CONIFEROUS EVERGREENS

- A. Form and Size: Specimen-quality, exceptionally heavy, tightly knit, symmetrically shaped coniferous evergreens.
- B. Provide balled and burlap coniferous evergreens.
 - 1. Container-grown coniferous evergreens will be acceptable in lieu of balled and burlap coniferous evergreens subject to meeting ANSI Z60.1 limitations for container stock and provided they are equal in quality and size to balled and burlap material.

2.5 BROADLEAF EVERGREENS

- A. Form and Size: Normal-quality, well-balanced, broadleaf evergreens, of type, height, spread, and shape required, conforming to ANSI Z60.1.
- B. Provide balled and burlap broadleaf evergreens.
 - 1. Container-grown broadleaf evergreens will be acceptable in lieu of balled and burlap broadleaf evergreens subject to meeting ANSI Z60.1 limitations for container stock and provided they are equal in quality and size to balled and burlap material.

2.6 GRASS/LAWN MATERIALS

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with the Association of Official Seed Analysts' "Rules for Testing Seeds" for purity and germination tolerances.
 - 1. Seed Mixture: Provide seed of grass species and varieties as specified in the plans and/or specifications.
 - 2. Sod shall be as indicated on the plans and detail drawings. Provide machine cut, strongly rooted, certified turf grass sod, not less than two years old, free from weeds and undesirable native grasses and stripped not more than 24 hours before laying. Sod pad size shall be uniform thickness of 5/8", plus or minus 1/4", measured at the time of cutting and excluding top growth and thatch.

2.7 TOPSOIL

- A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, 4 percent organic material minimum, free of stones 1 inch (25 mm) or larger in any dimension, and other extraneous materials harmful to plant growth. Sticks, roots, and clay clumps shall be removed from topsoil prior to spreading.
 - 1. Topsoil Source: Reuse surface soil stripped and stockpiled on the site if adequate quantities exist. Verify suitability of surface soil to produce topsoil meeting requirements and amend when necessary. Screen topsoil of roots, plants, sods, stones greater than 1/2" diameter in general lawn areas and planting beds, clay lumps, and other extraneous materials harmful to plant growth. Screen topsoil prior to planting. If inadequate quantities of topsoil exist on-site contractor will be required to import pre-screened topsoil. A minimum depth of 3 inches shall be required.

2.8 SOIL AMENDMENTS

- A. Lime: ASTM C 602, Class T, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent, with a minimum 99 percent passing a No. 8 (2.36 mm) sieve and a minimum 75 percent passing a No. 60 (250 micrometer) sieve.
 - 1. Provide lime in the form of dolomitic limestone.
- B. Organic Compost: Organic compost of neutral character, decomposed, stable and weed-free meeting the US Composting Council standards.
- C. Perlite: Horticultural perlite, soil amendment grade.

- D. Peat Humus: Finely divided or granular texture, with a pH range of 6 to 7.5, composed of partially decomposed moss peat (other than sphagnum), peat humus, or reed-sedge peat.
- E. Peat Humus: For acid-tolerant trees and shrubs, provide moss peat, with a pH range of 3.2 to 4.5, coarse fibrous texture, medium-divided sphagnum moss peat or reed-sedge peat.
- F. Sawdust or Ground-Bark Humus: Decomposed, nitrogen-treated, of uniform texture, free of chips, stones, sticks, soil, or toxic materials.
 - 1. When site treated, mix with at least 0.15 lb (2.4 kg) of ammonium nitrate or 0.25 lb (4 kg) of ammonium sulfate per cu. ft. (cu. m) of loose sawdust or ground bark.
- G. Manure: Well-rotted, un-leached stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.
- H. Herbicides: EPA registered and approved, of type recommended by manufacturer.
- I. Water: Potable.
- J. Mycorrhizae: Applied to planting hole backfill or planting bed solid. Product shall be formulated for the moisture regime of the particular planting location (low, medium, high) contain a broad spectrum of mycorrhizae species, an organic bi-stimulant (2-2-2 preferred) and a water holding gel (low moisture locations only). Apply per manufacturer's recommendations.

2.9 FERTILIZER

- A. Bonemeal: Commercial, raw, finely ground; minimum of 4 percent nitrogen and 20 percent phosphoric acid.
- B. Superphosphate: Commercial, phosphate mixture, soluble; minimum of 20 percent available phosphoric acid.
- C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea-form, phosphorous, and potassium in the following composition:
 - 1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency and as needed to maintain plant material and lawns in a thriving condition.
- D. Slow-Release Fertilizer: Granular fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 - 1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency and as needed to maintain plant material and lawns in thriving condition.

2.10 MULCHES

- A. Organic Mulch: Organic mulch, free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of the following:
 - 1. Dyed brown double shredded Hardwood Mulch: At least 80% hardwoods with moisture content of 30% or less, that can pass through a maximum screen size of 1 5/8". Raw material shall contain no yard waste, construction debris, or any other extraneous material.
 - a. Depth: 3" (after compaction)
 - b. Refer to plans for location.

2.11 EROSION-CONTROL MATERIALS

- A. Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.
- B. Fiber Mesh: Biodegradable twisted jute or spun-coir mesh, 0.92 lb per sq. yd. (0.5 kg per sq. m) minimum, with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.

2.12 STAKES AND GUYS

- A. Upright and Guy Stakes: Rough-sawn, sound, new hardwood, redwood, or pressure-preservative-treated softwood, free of knots, holes, cross grain, and other defects, 2 by 2 inches (50 by 50 mm) by length indicated, pointed at one end.
- B. Use flexible Arbor tape or equivalent 3/4" woven belt synthetic fabric strap installed per manufacturer's specifications. Color: Green.
- C. Flags: Standard surveyor's plastic flagging tape, pink, 6 inches (150 mm) long.
NOTE: Clearly mark all guy wires with flagging for visibility, especially near recreation and pedestrian areas.

2.13 LANDSCAPE EDGINGS

- A. "V" Ditch: A 4-inch deep trench by 6 inches width around all planting beds. Except where beds are adjacent to naturally wooded areas due to the possible damage to existing tree roots. Use care around existing tree roots in and around all planting beds. Do not cut existing tree roots to form the "V" ditch, work around them wherever possible.

2.14 MISCELLANEOUS MATERIALS

- A. Anti-desiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's instructions. Apply as per nursery's recommendations. It should be applied prior to plant transport from the nursery where it is dug, if in full leaf.

2.15 TACKIFIER

- A. Non-asphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.
- B. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors. (9 gals/1,000 SF).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive landscaping for compliance with requirements and for conditions affecting performance of work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected. Do not seed the site until the Landscape Architect has reviewed the final grades.

3.2 PREPARATION

- A. Lay out individual tree and shrub locations and areas for multiple plantings. Entire areas for multiple plantings shall be chiseled to a depth of 12 inches and tilled and amended to a depth of 8 inches with the same soil mixture as is required for planting backfill material. Stake locations, outline areas, and secure Landscape Architect's acceptance before the start of planting work. Make minor adjustments as may be required.

3.3 PLANTING SOIL PREPARATION

- A. Before mixing, clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.
- B. Mix soil amendments and fertilizers with topsoil at rates indicated. Delay mixing fertilizer if planting does not follow placing of planting soil within a few days.
- C. For tree pit or trench backfill, mix planting soil before backfilling and stockpile at site.
- D. For planting beds, mix planting soil prior to planting.
 - 1. Mix lime with dry soil prior to mixing fertilizer. Prevent lime for lawn plantings from contacting roots of acid-tolerant plants.
- E. Do not attempt soil preparation of plant installation when soils are frozen, wet, in poor tilth or otherwise unsuitable for planting.

3.4 LAWN PLANTING PREPARATION

- A. Limit subgrade preparation to areas that will be planted in the immediate future.
- B. Loosen subgrade to a minimum depth of 8 inches. Remove stones larger than 1/2 inch (19 mm) in any dimension and sticks, roots, rubbish, and other extraneous materials. Remove excess gravel which will inhibit lawn establishment and survival.
- C. Spread topsoil to depth required to meet thickness, grades, and elevations shown, after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen.

1. Place approximately 1/2 the thickness of topsoil required. Work into top of loosened subgrade to create a transition layer and then place remainder of the topsoil.
- D. Preparation of Unchanged Grades: Where lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, prepare soil as follows:
1. Remove and dispose of existing grass, vegetation, and turf. Do not turn over into soil being prepared for lawns.
 2. Till surface soil to a depth indicated on soil test report, but at a minimum of 6 inches (150 mm). Apply required soil amendments and initial fertilizers and mix thoroughly into top 4 inches (100 mm) of soil. Trim high areas and fill in depressions. Till soil to a homogenous mixture of fine texture.
 3. Clean surface soil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.
 4. Remove waste material, including grass, vegetation, and turf, and legally dispose of it off the Owner's property.
- E. Grade lawn and grass areas to a smooth, even surface with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future. Remove trash, debris, stones larger than 1 inch in any dimension, and other objects that may interfere with planting or maintenance operations. Remove all glass, wire or other objects of any size which may cause injury.
- F. Moisten prepared lawn areas before planting when soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- G. Restore prepared areas if eroded or otherwise disturbed after fine grading and before planting.
- H. Contact Owner and Landscape Architect for review and approval of seedbed preparation and seeding methods prior to and during seeding operations.

3.5 EXCAVATION FOR TREES AND SHRUBS

- A. Pits and Trenches: Excavate with vertical sides and with bottom of excavation slightly raised at center to assist drainage. Loosen hard subsoil in bottom of excavation. Refer to planting details.
1. Place tree in pit by lifting and carrying the tree by its ball (never lift by branches or trunk) and then lowering it into the pit. Set the tree straight, plumb and in the center of the pit with the most desirable side of the tree facing the prominent view (sidewalk, building, street, etc.).
 2. Determine the elevation of the root flare and ensure that it is planted at or slightly above finished grade. This may require that the tree be set higher than the grade in the nursery. If the root flare is less than 2-inches below the soil level of the root ball, plant the tree at the appropriate level above the grade, so the flare is even with the grade. If the flare is more than 2-inches at the center of the root ball above the grade, the tree shall be rejected.
- B. Obstructions: Notify Landscape Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

- C. Drainage: Notify Landscape Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub pits.
- D. Fill excavations with water and allow to percolate out, before placing setting layer and positioning trees and shrubs.

3.6 PLANTING TREES AND SHRUBS

- A. Set balled and burlap stock plumb and in center of pit or trench with top of ball raised above adjacent finish grades as indicated.
 - 1. Place stock on setting layer of compacted planting soil.
 - 2. Remove burlap from tops of balls and partially from sides, but do not remove from under balls. Remove the top 2/3's of the wire baskets. Remove pallets, if any, before setting. Do not use planting stock if ball is cracked or broken before or during planting operation.
 - 3. Place backfill around ball in layers, tamping to settle backfill and eliminate voids and air pockets. When pit is approximately 1/2 backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing and tamping final layer of backfill.
- B. Set container-grown stock plumb and in center of pit or trench with top of ball raised above adjacent finish grades as indicated.
 - 1. Carefully remove containers so as not to damage root balls.
 - 2. The root ball shall be loosened to alleviate matted or encircling roots. Roots shall be spread out evenly in an outward, radial fashion.
 - 3. Place stock on setting layer of compacted planting soil.
 - 4. Place backfill around ball in layers, tamping to settle backfill and eliminate voids and air pockets. When pit is approximately 1/2 backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing and tamping final layer of backfill.
- C. Dish and tamp top of backfill to form a 3-inch- (75-mm-) high mound around the rim of the pit. Do not cover top of root ball with backfill.
- D. Wrap trees of 2-inch (50-mm) caliper and larger with trunk-wrap tape if the species is susceptible to sun or wind scorch. Start at base of trunk and spiral cover trunk to height of first branches. Overlap wrap, exposing half the width, and securely attach without causing girdling. Inspect tree trunks for injury, improper pruning, and insect infestation and take corrective measures required before wrapping. Do not wrap the trees at the base to discourage insect infestation.

3.7 TREE AND SHRUB PRUNING

- A. Prune, thin, and shape trees and shrubs as directed by Landscape Architect.
- B. Only minimal pruning should be necessary at time of planting since plant material shall conform to the specified standards for quality. All pruning performed by the Contractor shall conform to the standards of the current ANSI A300, American National Standard for tree care operations. Under no circumstances shall the Contractor cut or prune leaders or remove more than 1/3 of the top without permission of the Landscape Architect. Prune to remove dead wood,

crossovers, split or broken branches. Do not shorten, trim or clip branches solely for appearance purposes unless directed to by the Landscape Architect.

3.8 TREE AND SHRUB GUYING AND STAKING

- A. Upright Staking and Tying: Stake trees of 2- through 5-inch (50- through 125-mm) caliper. Stake trees of less than 2-inch (50-mm) caliper only as required to prevent wind tip-out. Use a minimum of 2 stakes of length required to penetrate at least 18 inches (450 mm) below bottom of backfilled excavation and to extend at least 72 inches (1800 mm) above grade. Set vertical stakes and space to avoid penetrating balls or root masses. Support trees with 2 strands of flexible Arbor tape or equivalent ¾" woven belt synthetic fabric strap at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree. Flag heavily in recreation areas or any places where children are likely to be.

3.9 MULCHING

- A. Mulch backfilled surfaces of pits, trenches, planted areas, and other areas indicated.
- B. Organic Mulch: Apply the following average thickness of organic mulch and finish level with adjacent finish grades. Do not place mulch against trunks or stems. Refer to section 2.10 for additional information.

- 1. Thickness: 4 inches (mulch depth shall be 3" after compaction and settling).

NOTE: Mulch shall NOT be from on-site chipping operations (unless specifically indicated in plans and specifications).

3.10 SEEDING NEW LAWNS

- A. Sow seed with a spreader or a seeding machine. Do not broadcast or drop seed when wind exceeds 5 mph (8 km/h). Evenly distribute seed by sowing equal quantities in 2 directions at right angles to each other.
 - 1. Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage.
- B. Sow seed at the rates required to achieve 95% coverage prior to Final completion as determined on a per square yard basis.
- C. Rake seed lightly into top 1/8 inch (3 mm) of topsoil, roll lightly, and water with fine spray. Remove surface rocks of greater than 1" diameter.
- D. Protect seeded slopes 6:1 (H:V) and steeper against erosion with erosion-control blankets installed and stapled according to manufacturer's recommendations.
- E. Protect seeded areas with slopes flatter than 6:1 against erosion by spreading straw mulch after completion of seeding operations. Spread uniformly at a minimum rate of 2 tons per acre (45 kg per 100 sq. m) to form a continuous blanket 1-1/2 inches (38 mm) loose depth over seeded areas. Spread by hand, blower, or other suitable equipment. Tack with liquid asphalt tack (9 gals/1,000 SF) or non-asphaltic tackifier.

- F. If seeding occurs in summer months, protect seeded areas against hot, dry weather or drying winds by applying peat mulch within 24 hours after completion of seeding operations. Soak and scatter uniformly to a depth of 3/16 inch (4.8 mm) thick and roll to a smooth surface.

3.11 HYDROSEEDING NEW LAWNS

- A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogenous slurry suitable for hydraulic application.
 - 1. Mix slurry with non-asphaltic tackifier.
 - 2. Apply slurry uniformly to all areas to be seeded in a 2-step process. Apply first slurry application at the minimum rate of 500 lb per acre (5.5 kg per 100 sq. m) dry weight but not less than the rate required to obtain specified seed-sowing rate. Apply slurry cover coat of fiber mulch at a rate of 1000 lb per acre (11 kg per 100 sq. m).

3.12 RECONDITIONING LAWNS

- A. Recondition existing lawn areas damaged by Contractor's operations, including storage of materials or equipment and movement of vehicles. Also recondition lawn areas where settlement or washouts occur or where minor regrading is required.
- B. Remove sod and vegetation from diseased or unsatisfactory lawn areas; do not bury into soil. Remove topsoil containing foreign materials resulting from Contractor's operations, including oil drippings, fuel spills, stone, gravel, and other construction materials, and replace with new topsoil.
- C. Where repairable lawn remains, as determined by the Owner, mow, dethatch, core aerate, and rake heavily and deeply. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.
- D. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of it off the Owner's property.
- E. Till stripped, bare, compacted or otherwise unrepairable areas thoroughly to a depth of 8 inches.
- F. Apply required soil amendments and initial fertilizers and mix thoroughly into top 4 inches (100 mm) of soil. Provide new planting soil as required to fill low spots and meet new finish grades.
- G. Apply seed and protect with straw mulch as required for new lawns.
- H. Water newly planted areas and keep moist until new grass is established.

3.13 SODDING NEW LAWNS

- A. Lay sod to form solid, uniform mass with tightly fitted joints. "Butt" ends and sides of sod strips. Do not overlap sod strips. Stagger strips to offset joints in adjacent courses. Lay sod strips across slopes and perpendicular to drainage flow. Tamp or roll lightly to ensure contact with subgrade.

- B. Secure with pegs or staples at spacing recommended by the sod grower and supplier and as approved by the Landscape Architect and Owner.
- C. Water sod with fine spray immediately after planting. Water daily during first two weeks of establishment to maintain soil to depth of 4”.
- D. At no time shall sodded turf be allowed to grow over 3 inches in height. Throughout this period, the target mowing height shall be 1.5 inches. At no time shall more than 50% of the turf height be removed in any three-day period by mowing or other maintenance activity.
- E. Sodded turf shall be fertilized according to the monthly application rates recommended in Carolina Lawns for the utilized grass or at reduced rate if instructed by the Landscape Architect.
- F. Weed control shall be provided as necessary to prevent the establishment or proliferation of a weed species and to achieve acceptable turf at time of initial Acceptance.
- G. Remove all poly mesh netting prior to placement and dispose of off-site.

3.14 INSTALLATION OF EDGINGS

- A. “V” Ditches: Clearly delineate planting beds and sign locations with a 4-inch deep by 6-inch wide ditch. Lines shall be smooth. A minimum five-foot wide lawn strip shall be provided between planting beds and paved surfaces where shown on the drawings.

3.15 INSTALLATION OF MISCELLANEOUS MATERIALS

- A. Apply anti-desiccant using power spray to provide an adequate film over trunks, branches, stems, twigs, and foliage.
 - 1. When deciduous trees or shrubs are moved in full-leaf, spray with anti-desiccant at nursery before moving and again 2 weeks after planting.

3.16 INSPECTION AND ACCEPTANCE

- A. When landscape work is completed, including maintenance, Architect will, upon written request, make a final inspection to determine acceptability.
- B. At time of inspection for initial Acceptance, turf shall have been freshly mowed within the last 48 hours. Turf shall be healthy, of uniform color and exhibiting signs of good growth. A minimum of 95% of the specified seeding area shall be covered in established turf possessing both stolens (i.e. runners) and rhizomes. There shall be no bare areas greater than 4 sq. ft. or 1.5 ft. in any dimension. Seedling plants not having reached tiller stage (i.e. runner producing) shall be considered bare area. Turf shall be 100% free of noxious and perennial weeds and relatively free of annual weeds.
- C. At time of inspection for initial Acceptance, sodded and sprigged turf shall have been freshly mowed within the last 48 hours. Turf shall be healthy, of uniform color and exhibiting good growth. A minimum of 100% of the specified turf area shall be covered in sod that has been installed for a minimum six weeks. Turf shall be 100% free of all weeds.

- D. When inspected landscape work does not comply with requirements, replace rejected work and continue specified maintenance until re-inspected by Architect and found to be acceptable. Remove rejected plants and materials promptly from project site.

3.17 CLEANUP AND PROTECTION

- A. During landscaping, keep pavements clean and work area in an orderly condition.
- B. Protect landscaping from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed.

3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of it off the Owner's property unless an agreement is made with the Owner otherwise.

END OF SECTION 329000

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SECTION 331000 – SITE WATER UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes water systems piping for potable water service and fire protection service outside the building.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 15 Sections for fire protection systems inside building.
 - 2. Division 15 Sections for water distribution systems inside building.
 - 3. Division 31 Section “Earth Moving” for excavation, trenching, and backfilling.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure Ratings: Except where otherwise indicated, the following are minimum pressure requirements for water system piping.
 - 1. Underground Piping: 150 psi.

1.4 SUBMITTALS

- A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.
- B. Product data, including pressure rating, rated capacity, and settings of selected models for the following:
 - 1. Meter boxes.
 - 2. Backflow preventers.
 - 3. Valves and boxes.
 - 4. Fire hydrants.
 - 5. Fire department connections.
 - 6. Yard hydrants.
 - 7. Identification materials and devices.
 - 8. Pipe and fittings.
 - 9. Alarm devices.
 - 10. Indicator posts.
 - 11. Meter vaults and boxes.
 - 12. Backflow prevention devices and enclosures.
 - 13. Tapping sleeves and saddles.

- C. Shop drawings for precast concrete pits. Include frames and covers. Include drains when indicated.
- D. Coordination drawings showing pipe sizes and valves, meter and specialty locations and elevations, if applicable. Include details of underground structures, connections, anchors, and reaction backing. Show other piping in same trench and clearances from water system piping. Indicate interface and spatial relationship between piping and proximate structures.
- E. Record drawings at Project closeout of installed water system piping and products according to Division 1.
- F. As-Built survey of installed water system. Perform and submit as-built survey as soon as possible following installation of water main piping and appurtenances. Survey shall be submitted at least 60-days prior to needed use of water main.
- G. Test reports specified in "Field Quality Control" Article in Part 3. Submit test reports at least 60-days prior to needed use of water main.

1.5 QUALITY ASSURANCE

- A. All materials, construction methods and testing shall comply with the requirements of the Town of Farmville Standards.
- B. Provide listing/approval stamp, label, or other marking on equipment made to specified standards.
- C. Listing and Labeling: Provide equipment and accessories that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in "National Electrical Code," Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- D. Product Options: Water systems specialties and accessories are based on specific types, manufacturers, and models indicated. Components by other manufacturers but having equal performance characteristics may be considered, provided deviations in dimensions, operation, and other characteristics do not change design concept or intended performance as judged by Architect and the Town of Farmville. The burden of proof of equality and approval by the Town of Farmville of products is on the Contractor. Refer to Division 1 sections.
- E. All work within any NCDOT right-of-way shall conform to the requirements of the current version of the NCDOT's Policies and Procedures for Accommodating Utilities on Highway Rights of Way, the provisions and conditions of the encroachment agreement(s), and other applicable NCDOT standards and policies. The encroachment agreement(s) are considered part of the project specifications by reference. Copies of the agreement(s) will be provided upon request from the Architect.
- F. Perform As-Built Survey of installed water system piping and products. As-built survey shall be submitted in digital (dwg) and hard copy formats. The hard-copy shall be signed and sealed by a NC Professional Land Surveyor. Survey shall include the following:

1. All fire hydrant water valve sizes and locations with no less than two primary reference dimensions from permanent above grade features.
2. Locations of bacteriological sampling points.
3. Pipe materials and sizes.
4. Other water system components such as meters, backflow preventers, etc.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Transport: Prepare valves, including fire hydrants, for shipping as follows:
1. Ensure that valves are dry and internally protected against rust and corrosion.
 2. Protect valves against damage to threaded ends, flange faces, and weld ends.
 3. Set valves in best position for handling. Set valves closed to prevent rattling.
- B. Storage: Use the following precautions for valves, including fire hydrants, during storage:
1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
 2. Protect valves from weather. Store valves indoors and maintain temperature higher than ambient dew point temperature. Support valves off ground or pavement in watertight enclosures when outdoor storage is necessary.
- C. Handling: Use sling to handle valves and fire hydrants whose size requires handling by crane or lift. Rig valves to avoid damage to exposed valve parts. Do not use handwheels or stems as lifting or rigging points.
- D. Deliver pipes and tubes with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- E. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- F. Protect flanges, fittings, and piping specialties from moisture and dirt.
- G. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 PROJECT CONDITIONS

- A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.
- B. Verify that water system piping may be installed in compliance with original design and referenced standards.
- C. Site Information: Reports on subsurface condition investigations made during the design of the Project are available for informational purposes only; data in reports are not intended as representations or warranties of accuracy or continuity of conditions (between soil borings). Owner assumes no responsibility for interpretations or conclusions drawn from this information.

1.8 SEQUENCING AND SCHEDULING

- A. Coordinate connection to water main with Town of Farmville. Obtain all necessary permits for pavement cuts, line taps, etc. from the authorities having jurisdiction.
- B. Coordinate with pipe materials, sizes, entry locations, and pressure requirements of building fire protection and building water distribution systems piping.
- C. Coordinate with other utility work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work are specified herein. Products by other manufacturers having equal performance characteristics may be considered, however approval must be acquired by the Contractor from the Town of Farmville.

2.2 PIPES AND TUBES

- A. Ductile-Iron Pipe: AWWA C150 and C151, laying condition Type 1 and working pressure of 350 psi. All ductile-iron pipe shall be listed by ANSI/NSF Standard 61 for potable water contact.
 - 1. Lining: AWWA C104, cement mortar, bituminous seal coated.
 - 2. Gaskets, Glands, and Bolts and Nuts: AWWA C111.
 - 3. Push-On-Joint-Type Pipe: AWWA C111, rubber gaskets.
 - 4. Mechanical-Joint-Type Pipe: AWWA C111, rubber gaskets, ductile- or cast-iron glands, and steel bolts and nuts.
 - 5. Coating: AWWA C151, bituminous coating.
 - 6. Restrained-Joints: All restrained joint ductile iron pipe unless otherwise specified shall be of the boltless restrained joint type as assembled with a steel flexible ring that locks into position inside the bell of the connecting pipe. The locking rings shall be one-piece construction. For installations requiring welded locking rings, the rings shall be factory welded. The restrained joints shall provide a minimum of 4-degrees of deflection for pipe sizes, 4-inches through 12-inches in diameter.
- B. Copper Tube: ASTM B 88, Types K, seamless water tube, annealed temper. All copper pipe shall be NSF Listed for potable use.

2.3 PIPE AND TUBE FITTINGS

- A. Ductile-Iron and Cast-Iron Pipe Fittings: AWWA C110, ductile-iron or cast-iron, 250-psig minimum pressure rating; or AWWA C153, ductile-iron compact fittings, 250-psig pressure rating. All ductile-iron fittings shall be listed by ANSI/NSF Standard 61 for potable water contact.
 - 1. Lining: AWWA C104, cement mortar.
 - 2. Gaskets: AWWA C111, rubber.
 - 3. Joints: AWWA C111, mechanical joint, all bell.
 - 4. Coating: AWWA C151, bituminous coating.

- B. Copper Tube Fittings: AWWA C800, flared copper type brass fittings. All copper fittings shall be NSF Listed for potable use.

2.4 VALVES

- A. Gate Valves 3 Inches and Larger: AWWA C509 or AWWA C515, resilient seated; bronze stem, cast-iron or ductile-iron body and bonnet, stem nut, 250-psig working pressure, minimum UL/FM rating of 200-psi. All coating materials shall comply with NSF 61.
 - 1. Gate valves shall be fusion bonded epoxy, (FBE) coated both interior and exterior at a minimum of 10mils and the FBE coating shall be provided in conformance with AWWA C550. The gate valve wedge shall be fully encapsulated in rubber. All sealing gaskets shall be made of EPDM rubber materials.
 - 2. All valves shall be rated for bi-directional flow.
 - 3. Gate valves shall be restrained by stainless steel rodding, concentric ring restrained connections or wedge action retainer glands. In all cases, the valve and piping shall be restrained on both sides to sufficiently allow the valve to function as a dead end.
 - 4. All gate valves shall open left with a non-rising stem and be provided with a 2-inch square operating nut and mechanical joint ends except for valves installed in vaults or other enclosures which shall be rising stem with flanged ends.
 - 5. All gate valves shall be constructed with triple O-ring seals in which 2 O-rings are located above the thrust collar and 1 O-ring is located below the thrust collar. The two upper O-rings shall be replaceable with the valve fully open and subjected to full rated working pressure.
 - 6. Post Indicator Valves shall be non-rising stem with flange for indicator post.
- B. Non-rising Stem Gate Valves, 2 Inches and Smaller: MSS SP-80; body and screw bonnet of ASTM B 62 cast bronze; with Class 125 threaded ends, solid wedge, non-rising copper-silicon alloy stem, brass packing gland, polytetrafluoroethylene (PTFE)-impregnated packing, and malleable-iron handwheel.
- C. Curb Stop Ball Valves 2 Inches and Smaller: 300-psi, AWWA C800, certified low-lead per NSF. Bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material. Provide 2-inch wrench nut adapter on each valve.
- D. Valve Boxes: Cast-iron box having top section and cover with lettering "WATER," bottom section with base of size to fit over valve and barrel approximately 5 inches in diameter, boxes shall be of the screw or telescopic type, valve box ring adjustments will not be allowed. The valve box shall be centered over the wrench nut and seated on compacted backfill without touching the valve assembly. All valve boxes shall be encased in a trowel finished 2' x 2' x 6" pad of 3000-psi concrete beneath the asphalt with the cover flush with the top of the pavement or flush with the finished grade. Precast concrete valve box encasements may be used for valve box encasement outside of paved areas provided the assembly is buried flush with the surface grade and compacted properly to prevent movement of the precast encasement.
- E. Tapping Sleeve and Tapping Valve: Complete assembly, including tapping sleeve, tapping valve, and bolts and nuts. Use sleeve and valve compatible with tapping machine.
 - 1. Tapping sleeves shall be fabricated of ductile iron construction in a two-piece assembly with mechanical joint connections to the main line and flanged connection to the tapping valve.

2. All MJ tapping sleeves shall be rated for a working pressure of 200-psi or greater and provided with a 3/4-inch test plug for testing. All tapping sleeves shall be hydrostatically tested up to 200-psi before a tap is made. Tapping sleeves shall NOT be air tested.
3. All mechanical joint tapping sleeves shall be manufacturer fabricated and approved for installation on the specific main line pipe material, whether ductile iron or asbestos cement.

2.5 FIRE HYDRANTS

- A. Hydrants shall conform to AWWA C502 with a minimum valve opening of 4 1/2 inches. Mechanical joint, bronze to bronze seating, minimum 4 foot bury depth with a break away ground line flange and break away rod coupling. The hydrant bonnet shall be designed with a sealed oil or grease reservoir with O-ring seals and a Teflon thrust bearing. All fire hydrants shall be designed and rated for a working pressure of 250-psi or greater.
 1. Outlets: One 4 1/2 inch steamer and double 2 1/2 inch hose connections with National Standard Threads. Include cast-iron caps with minimum 2/0 twist link, heavy -duty, non-kinking, machine chains.
 2. Operating and Cap Nuts: Pentagon 1-1/2 inch point to flat.
 3. Direction of Opening: Open hydrant valve by turning operating nut to the left, or counterclockwise.
 4. Finish: Red exterior alkyd gloss enamel paint.

2.6 ANCHORAGES

- A. Thrust Blocking: Thrust restraint blocking for all fittings or components subject to hydrostatic thrust shall be securely anchored by the use of concrete thrust blocks poured in place. The reaction areas are shown in the Details. No concrete shall interfere with the removal of fittings. Material for reaction blocking shall be 3,000-psi concrete. A minimum 4 mil plastic shall cover the fitting to ensure that no concrete will interfere with removal of the fitting.
- B. Rodding: All rodding shall be constructed with type 304 stainless steel rods at the number and sizing specified in the following table. Rod coupling shall not be allowed. Rodding requirements are as follows:

4-in branch.....	2, 3/4-in steel rods
6-in branch.....	2, 3/4-in steel rods
8-in branch.....	4, 3/4-in steel rods
12-in branch.....	6, 3/4-in steel rods
- C. Wedge Action Retainer Glands: Wedge action retainer glands may be used as a substitute for rodding, but shall not substitute for typical reaction blocking. All wedge action retainer glands shall be manufactured as a one piece retainer gland for use with mechanical joint fittings and shall be rated to provide restraint up to 350-psi pressure rating for sizes through 16-inches. For sizing above 16-inches, the wedge action retainer gland shall be rated to provide restraint up to 250-psi. Approved wedge action retainer glands shall be made of ductile iron, coated with a manufacturer applied epoxy coating or polyester powder coating.
 1. In cases where wedge action retainer glands are approved for pipe restraint of fire hydrant supply lines or other applications, the wedge action retainer gland shall be joined with a mechanical joint pipe bell and the entire hydrant supply line shall be restrained. Wedge action retainer gland connections to push on pipe are not allowed.

2.7 IDENTIFICATION

- A. Metallic-Lined Plastic Underground Warning Tapes: Polyethylene plastic tape with metallic core, 6 inches wide by 4 mils thick, solid blue in color with continuously printed caption in black letters "CAUTION - WATER LINE BURIED BELOW."

PART 3 - EXECUTION

3.1 GENERAL

- A. All construction shall conform to the Standard Specifications and Details of the Town of Farmville and the NCDOT as applicable in addition to the requirements state herein.

3.2 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.3 SERVICE ENTRANCE PIPING

- A. Extend water system piping and connect to water supply source and building water distribution and fire protection systems in locations and pipe sizes indicated.
 - 1. Terminate domestic water system piping at 5-feet outside building wall until building water systems are installed. Terminate piping with caps, plugs, or other fittings as required for piping material. Make connections to building water system when those systems are installed.
 - 2. Terminate fire protection water system 12-in above finish floor elevation within building with caps, plugs, or flanges as required for piping material. Coordinate exact location with fire protection contractor. Install restrained joints for buried piping within 60 inches of building. Use restrained-joint pipe and fittings, thrust blocks, anchors, tie-rods and clamps, and other supports at vertical and horizontal offsets.

3.4 JOINT CONSTRUCTION

- A. Ductile-Iron Piping Gasketed Joints: Construct joints according to AWWA C600.
- B. Flanged Joints: Align flanges and install gaskets. Assemble joints by sequencing bolt tightening. Use lubricant on bolt threads. Flanged joints shall be used in vaults or above grade installations only.

3.5 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. General Locations and Arrangements: Drawings indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated except where deviations to layout are approved on coordination drawings.
- B. Install piping at indicated slope.
- C. Install components having pressure rating equal to or greater than system operating pressure.

- D. Install piping free of sags and bends.
- E. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
- F. Install fittings for changes in direction and branch connections.
- G. Piping Connections: Except as otherwise indicated, make piping connections as specified below within vaults or above-ground. Do not use flanges, unions or keyed couplings at underground installations.
 - 1. Above grade: Install unions, in piping 2 inches and smaller, adjacent to each valve and at final connection to each piece of equipment having 2-inch or smaller threaded pipe connection.
 - 2. Above grade: Install flanges, in piping 2-1/2 inches and larger, adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.
 - 3. Below grade: Join copper pipe with flared copper type brass fittings.
 - 4. Below grade: Join ductile iron pipe with push-on joints. Join fittings with mechanical joints.
 - 5. Install dielectric fittings to connect piping of dissimilar metals.

3.6 PIPING INSTALLATION

- A. Water Main Connection: Tap water main with size and in location as indicated according to requirements of the Town of Farmville.
 - 1. Install tapping sleeve and tapping valve according to manufacturer's installation instructions.
 - 2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
 - 3. Install gate valve onto tapping sleeve. Comply with AWWA C600. Install valve with stem pointing up and with cast-iron valve box.
 - 4. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water service piping.
 - 5. Install service clamps and corporation stops in size, quantity, and arrangement required by Town of Farmville standards and according to manufacturer's installation instructions.
 - 6. Install service clamps on pipe to be tapped. Position outlet for corporation stop.
 - 7. Install corporation stops into service clamps. Install valve with stem pointing up and with cast-iron valve box.
 - 8. Install curb stop in service piping with head pointing up and with cast-iron service box.
 - 9. Install manifold for multiple taps in water main.
 - 10. Use drilling machine compatible with service clamp and corporate stop. Drill hole in main. Remove drilling machine and connect water service piping.
- B. Comply with requirements of NFPA 24 for materials and installation.
- C. Install ductile-iron pipe and ductile-iron and cast-iron fittings according to AWWA C600.
- D. Install copper tube and wrought-copper fittings according to CDA No. 404/0 "Copper Tube Handbook."

- E. Bury piping at minimum depth of 3 feet below finished subgrade and not less than 18 inches below average local frost depth.
- F. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or a combination of both.
- G. Shoring or bracing of pits, trenches and other excavations shall be in accordance with the requirements of NCDOT and OSHA.
- H. The subgrade at the bottom of the trench shall be shaped to secure uniform support throughout the length of the pipe. A space shall be excavated under the bell of each pipe to provide space to relieve bearing pressure on the bell and provide room to adequately make the joint.
- I. Open ends of pipe shall be plugged with a standard plug or cap at all times when pipe laying is not in progress. Trench water shall not be permitted to enter pipe.
- J. Backfill material shall be free from stones greater than 4-inches in diameter, construction material debris, frozen material, organic matter, or unstable material. Backfill materials shall be placed in loose lifts of 8-inches or less in depth. All backfill shall be compacted to not less than 95% of the standard Proctor maximum dry density except the final foot beneath pavement or slab areas where this requirement shall be increased to 98% of the standard Proctor maximum dry density.
- K. Install and test fire protection piping and appurtenances in accordance with the specific requirements of the Town of Farmville and applicable NFPA requirements.

3.7 ANCHORAGE INSTALLATION

- A. Anchorages: Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
 - 1. Gasketed-Joint, Ductile-Iron Piping: According to AWWA C600.
 - 2. Fire Service Piping: According to NFPA 24.
- B. Apply full coat of asphalt or other acceptable corrosion-retarding material to surfaces of installed ferrous anchorage devices.
- C. Use thrust blocking anchorages unless noted otherwise.

3.8 FIRE HYDRANT INSTALLATION

- A. Install fire hydrants plumb and as indicated on the Drawings. Orient hydrant with pumper nozzle facing the closest curb of a fire lane or street, but not a parking space.
- B. The back of the hydrant opposite the pipe connection shall be firmly blocked against the vertical face of the trench with 1/3 cubic yard of concrete. Double bridle rods and collars shall be connected from the tee to the hydrant. Rods shall not be less than 3/4 inch diameter and made of stainless steel rod stock for corrosion protection. A minimum of 8 cubic feet of stone shall be placed around the drains. The backfill around the hydrants shall be thoroughly compacted and closely match the elevation on the approved plans. Hydrant extensions will not be allowed on new or retrofit installations.

- C. For fire hydrant installations outside of intersections, the Contractor may choose to utilize concentric ring restrained fittings in combination with concentric ring restrained gate valves and fire hydrants without typical blocking and rodding. In this case, the entire hydrant supply line shall be fabricated with restrained joints. The Contractor may also elect to utilize typical mechanical joint fittings, restrained with wedge action retainer glands. The wedge action retainer glands, shall be installed on all sides of the mechanical joint branch fitting, both sides of the valve, and the fire hydrant to restrain any mechanical joint pipe connections on the hydrant supply line.

3.9 IDENTIFICATION INSTALLATION

- A. Install continuous plastic underground warning tape during back-filling of trench for underground water service piping. Locate 6 inches to 8 inches below finished grade, directly over piping.
- B. Attach nonmetallic piping label permanently to main electrical meter panel.

3.10 FIELD QUALITY CONTROL

- A. General: All materials shall be inspected by the Town's inspector prior to installation. The Contractor shall furnish all materials, labor and equipment to perform all testing and inspections.
- B. Hydrostatic Testing:
 1. No valve in the Town water system shall be operated without authorization in accordance with the Town Standard Procedure 4, "Control and Monitoring of Water System Flow Activity." A section of line that is to be hydrostatically tested, shall be slowly filled with water at a rate which will allow complete evacuation of air from the line. Hand pumps shall not be used for the pressure testing of water mains. Taps used for testing purposes shall be removed after testing and repaired using a stainless steel full circle repair clamp.
 2. Fill the line slowly to avoid undue impacts associated with surge and to allow air to evacuate the pipeline. After all air has been expelled from the water main, the line shall be tested to a pressure of 200 psi as measured at the lowest elevation of the line for a duration of 2 hours. The testing period shall not commence until all air has been evacuated and the pressure has stabilized. The pressure gauge used in the hydrostatic test shall be calibrated in increments of 10-psi or less. The pressure gauge shall be liquid-filled and indexed for an operating range of 300-psi or less with a minimum dial size of 3-1/2 inches. At the end of the test period, the leakage shall be measured with an accurate water meter.
 3. Any measured leakage not within the allowable limits as specified in the following table shall require repair of the water main and additional testing until the standards are met. For pipe sizes other than those shown, the Contractor shall test within the allowable leakage amounts as specified by AWWA C600-99. All visible leaks shall be repaired regardless of the amount of leakage.

Pipe Size (in)	Allowable Leakage (Gal/Hr per 1000 ft of pipe)
4	0.38

6	0.57
8	0.76
12	1.15

- C. Disinfection: All additions or replacements to the water system shall be disinfected with chlorine in conformance with AWWA C651 before being placed in service under the supervision of the Town's Inspector in the following manner.

1. Taps shall be made at the control valve at the upstream end of the line and at all extremities of the line including valves.
2. A solution of water containing 70% HTH available chlorine shall be introduced into the line by regulated pumping at the control-valve tap. The solution shall be of such a concentration that the line shall have a uniform concentration of not less than 50-ppm and not more than 100-ppm total chlorine immediately after chlorination. The chart below shows the required quantity of 70% HTH compound to be contained in solution in each 1000 feet section of line to produce the desired concentration from 50-ppm to 100 ppm.

Pipe Size (in)	Lbs. of HTH (70%) Per 1000-ft of Pipe
6	0.88 – 1.76
8	1.56 – 3.12
10	2.42 – 4.84
12	3.50 – 7.00
14	4.76 – 9.52

3. The HTH Solution shall be circulated in the main by opening the control valve and systematically manipulating hydrants and taps at the line extremities. The HTH solution must be pumped in at a constant rate for each discharge rate so a uniform concentration will be produced in mains.
4. HTH solution shall remain in lines for no less than 24 hours or as directed by the Town's Inspector.
5. Extreme care shall be exercised at all times to prevent the HTH solution from entering existing mains.
6. Free residual chlorine after 24 hours shall be at least 10 ppm or the Inspector will require that the lines be re-chlorinated.

D. Flushing:

1. Flushing of lines may only proceed after 24 hours of disinfection contact time and as directed by Town staff, provided the free residual chlorine analysis is satisfactory.
2. At the completion of disinfection, chlorinated water flushed from the water main shall be disposed of in conformance with all Federal, State and local regulations.
3. In accordance with all applicable regulations, a neutralizing chemical shall be applied to minimize chlorine residual in the flushing water before discharging from the water main, unless an alternate plan is submitted in writing and approved by the Town.
4. Water used for disinfection shall be flushed from the water main until the chlorine residual concentration is below 5-ppm before initiating sampling.

E. Bacteriological and Turbidity Sampling

1. Bacteriological sampling shall be utilized to verify disinfection prior to placing a newly constructed water main in operational service. Bacteriological sampling shall consist of 2 consecutive sets of acceptable samples taken at least 24-hours apart and collected from each 1,200-ft section of water main and all dead ends and branches as outlined by ANSI/AWWA C651.
2. For the first round of sampling, the requested laboratory analysis shall be specified as follows: "Bacteriological Test and Turbidity." For the second round of testing, the laboratory analysis shall be specified as, "Bacteriological Test Only."
3. Samples for laboratory analysis shall be collected by the Town's Inspector after flushing is completed. The Contractor shall furnish the sample bottles, the testing agency and such help as may be required to secure these samples. The contractor shall make arrangements with the laboratory that all test results be submitted directly to the Town's inspector or other designee approved by the Engineering Inspector. All costs for laboratory testing shall be borne by the Contractor.
4. The laboratory secured for testing shall be certified by the State Laboratory of Public Health. All sample bottles for bacteriological sampling provided by the laboratory shall be sterilized and treated with a dechlorinating agent, such as sodium thiosulfate. Samples for turbidity shall be taken in plain sterilized bottles from the lab, which are separate from the bottles provided for bacteriological testing. The sample bottles shall be provided with tamper proof seals that will be adhered to the bottles by the Town's inspector. The inspector shall provide a sample identification number, job title and an identification of Phase 1 or Phase 2 sampling that will be provided on the tamper proof custody seal. The bottles and tamper proof custody seals shall be accompanied by a chain of custody form provided by the certified laboratory conducting the testing. All sample identification numbers, job titles, and Phase 1 or Phase 2 testing identification from the custody seal shall be recorded on the chain of custody forms by the Engineering Inspector.
5. All samples shall be collected in compliance with the sampling protocols provided by the certified laboratory, and processed for delivery under the direct supervision of the Engineering Inspector. The samples shall be collected by the Town's inspector or designee and kept in a cooler provided by the Contractor at approximately 40-degrees Fahrenheit or 4-degrees Celsius and delivered to the certified lab for testing as soon as possible. The time at which the sample is taken shall be recorded on the chain of custody form by the Engineering Inspector. Any samples processed at the laboratory more than 30-hours following collection shall be declared invalid, i.e. samples shall be submitted to the lab within 24-hours of collecting them.
6. All first round samples shall be tested for bacteriological quality and turbidity in accordance with standards established by NCDENR and AWWA. If turbidity exceeds 0.8 NTU, the sample shall fail and the system shall be re-flushed before initiating a new round of testing.
7. If the phase 1 sample results for bacteriological quality and turbidity are acceptable, then a second set of samples can be collected at least 24-hours following the first sample collection. No additional flushing other than required to obtain a representative sample will be allowed prior to collecting the second set of samples.
8. The second set of samples shall be tested for bacteriological quality only. All custody seals and chain of custody forms shall identify the second round samples as "Phase 2" testing to notify the lab that the first set of samples have already been evaluated and received a satisfactory laboratory analysis.
9. At the completion of sampling, the total chlorine concentration shall be at least 2-mg/L and no higher than 4-mg/L before the system can be made operational.
10. If test results are unsatisfactory, the Contractor shall immediately re-chlorinate lines and proceed with such measures as are necessary to properly disinfect the lines.

11. The new water system shall be valved off from the existing system until a satisfactory bacteriological laboratory analysis has been obtained and the Inspector has authorized the use of the new water system.
- F. Private Fire Service System Flushing & Testing: In addition to the testing, disinfection and flushing listed above, perform additional flushing and all tests as required by NFPA 14 and NFPA 24.
1. Complete and submit “Contractor’s Material and Test Certificate for Underground Piping” (NFPA 14) upon satisfactory completion of system flushing and all tests.
- G. Backflow Prevention Device Certification
1. All new or relocated backflow prevention devices shall be tested and certified by a licensed inspector prior to operation of the water system. Performance, coordination and submittal of documentation of the testing and certification shall be the responsibility of the Contractor.
- H. Contractor shall be responsible for ensuring all waterlines are fully flushed and free of all deleterious matter prior to connecting to the building plumbing system.

END OF SECTION 33 10 00

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SECTION 333000 SANITARY SEWERAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including the General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes sewerage systems outside the building.
- B. Related Sections: The following Sections contain requirements that relate to this Section.
 - 1. Division 3 Section "Cast-in-Place Concrete" for cast-in-place concrete structures.
 - 2. Division 15 Sections for sanitary sewer systems inside and adjacent to building, including grease interceptors.

1.3 DEFINITIONS

- A. Sewerage Piping: System of sewer pipe, fittings, and appurtenances for gravity flow of sanitary sewage.

1.4 PERFORMANCE REQUIREMENTS

- A. Gravity-Flow, Nonpressure-Piping Pressure Ratings: At least equal to system test pressure.

1.5 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for the following:
 - 1. Cleanouts.
 - 2. Pipe and fittings.
 - 3. Couplings.
 - 4. Manhole Appurtenances.
- C. Record drawings at Project closeout of installed water system piping and products according to Division 1.
- D. As-Built survey of installed sanitary sewer mains and manholes. Perform and submit as-built survey as soon as possible following installation of manholes and sewer main piping. Survey shall be submitted at least 60-days prior to needed use of sewer main.
- E. Inspection and test reports specified in the "Field Quality Control" Article.

1.6 QUALITY ASSURANCE

- A. Environmental Agency Compliance: Comply with regulations pertaining to sanitary sewerage systems.
- B. Utility Compliance: Comply with Town of Farmville regulations pertaining to sanitary sewerage systems.
- C. Product Options: Drawings indicate sizes, profiles, connections, and dimensional requirements of system components and are based on specific manufacturer types indicated. Other manufacturers' products with equal performance characteristics may be considered. Refer to Division 1 Section "Product Substitutions."
- D. All work within any NCDOT right-of-way shall conform to the requirements of the current version of the NCDOT's Policies and Procedures for Accommodating Utilities on Highway Rights of Way, the provisions and conditions of the encroachment agreement(s), and other applicable NCDOT standards and policies. The encroachment agreement(s) are considered part of the project specifications by reference. Copies of the agreement(s) will be provided upon request from the Architect.
- E. Perform As-Built Survey of installed sewer system piping and products. As-built survey shall be signed and seal by a NC Professional Land Surveyor and shall include the following:
 - 1. All manhole invert and rim elevations and horizontal locations with no less than two primary reference dimensions from permanent above grade features.
 - 2. All cleanout locations with no less than two primary reference dimensions from permanent above grade features.
 - 3. Pipe materials, sizes, lengths, and slopes.
 - 4. Other sewer system components such as grease traps, etc.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic structures in direct sunlight.
- B. Do not store plastic pipe or fittings in direct sunlight.
- C. Protect pipe, pipe fittings, and seals from dirt and damage.
- D. Handle precast concrete manholes and other structures according to manufacturer's rigging instructions.

1.8 PROJECT CONDITIONS

- A. Site Information: Perform site survey, research public utility records, and verify existing utility locations.
- B. Locate existing structures and piping to be closed and abandoned.
- C. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted under the following conditions and then only after arranging to provide acceptable temporary utility services.

1. Notify Architect not less than 48 hours in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without receiving Architect's written permission.

1.9 SEQUENCING AND SCHEDULING

- A. Coordinate sanitary sewerage system connections to utility company's sanitary sewer. Obtain all necessary permits for pavement cuts, line taps, etc. from the authorities having jurisdiction.
- B. Coordinate force main connection to existing force main with Owner.
- C. Coordinate with interior building drainage systems.
- D. Coordinate with other utility work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work are specified herein. Products by other manufacturers having equal performance characteristics may be considered, however approval must be acquired by the Contractor from the Town of Farmville.

2.2 PIPES AND FITTINGS

- A. Ductile-Iron Gravity Sewer Pipe & Fittings: AWWA C150 and C151, Pressure Class 350 with laying condition Type 1 (Type 4 for installations of greater than 16-ft of cover).
 1. Lining: AWWA C104, cement mortar, bituminous seal coated.
 2. Gaskets, Glands, and Bolts and Nuts: AWWA C111.
 3. Push-On-Joint-Type Pipe: AWWA C111, rubber gaskets.
 4. Mechanical-Joint-Type Pipe: AWWA C111, rubber gaskets, ductile- or cast-iron glands, and steel bolts and nuts.
 5. Standard-Pattern, Ductile-Iron and Cast-Iron Fittings: AWWA C110, for push-on joints.
 6. Compact-Pattern, Ductile-Iron Fittings: AWWA C153, for push-on joints.
 7. Coating: AWWA C151, bituminous coating.
- B. Polyvinyl Chloride (PVC) Gravity Sewer Main Pipe and Fittings: ASTM D 3034 for gasketed joints. PVC Pipe shall be solid wall and made of PVC plastic having a cell classification of 12454 or 12364 (with minimum tensile modulus of 400,000 psi) as defined in Specification D1784. PVC pipe shall have integral wall bell and spigot joints for the conveyance of domestic sewage and shall be supplied in minimum 14 or 20 ft lengths. Fittings shall be made of PVC plastic having a cell classification of 12454-B, as defined in ASTM D1784. Fittings must be manufactured by pipe supplier or approved equal, and have bell and/or spigot configurations compatible with that of the pipe. Compounds with superior properties are also acceptable.
 1. Thickness: SDR 35 for 4-ft to 12-ft installation depths.
 2. Thickness: SDR 26 for 12-ft to 30-ft installation depths.
 3. Gaskets: ASTM F 477, elastomeric seal.

- C. Polyvinyl Chloride (PVC) Gravity Sewer Service Pipe and Fittings: PVC service pipe shall be 4-in or 6-in, schedule 40 or greater supplied in minimum 18-ft lengths. Schedule 40 PVC pipe shall be manufactured with a cell classification of 12454 in conformance with ASTM D1784. Schedule 40 pipes shall be manufactured to dimensional tolerances as specified in ASTM D1785 and rated for service conditions up to temperatures of 140-degrees Fahrenheit. The pipe may be joined by solvent weld in conformance with ASTM D2564.

2.3 SPECIAL PIPE COUPLINGS AND FITTINGS

- A. Sleeve-Type Pipe Couplings: Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined, for nonpressure joints.
 - 1. Sleeves for Cast-Iron Soil Pipe: ASTM C 564, rubber.
 - 3. Sleeves for Plastic Pipe: ASTM F 477, elastomeric seal.
 - 4. Sleeves for Dissimilar Pipes: Compatible with pipe materials being joined.
 - 5. Bands: Stainless steel, at least one at each pipe insert.

2.4 CLEANOUTS

- A. Description: ASME A112.36.2M, round, cast-iron housing with clamping device and round, secured, scoriated, cast-iron cover. Include cast-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug. Use units with top-loading classifications according to the following applications:
 - 1. Light Duty: In earth or grass, foot-traffic areas.
 - 2. Medium Duty: In paved, foot-traffic areas.
 - 3. Heavy Duty: In vehicle-traffic service areas.
 - 4. Extra Heavy Duty: In roads.
- B. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, service class, cast-iron soil pipe and fittings.

2.5 MANHOLE CONNECTORS

- A. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

2.6 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318, ACI 350R, and the following:
 - 1. Cement: ASTM C 150, Type II.
 - 2. Fine Aggregate: ASTM C 33, sand.
 - 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 - 4. Water: Potable.
- B. Structures: Portland-cement design mix, 4000 psi minimum, with 0.45 maximum water-cement ratio.
 - 1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
 - 2. Reinforcement Bars: ASTM A 615, Grade 60, deformed steel.

- C. Structure Channels and Benches: Factory or field formed from concrete. Portland-cement design mix, 4000 psi minimum, with 0.45 maximum water-cement ratio.

PART 3 - EXECUTION

3.1 GENERAL

- A. All construction shall conform to the Standard Specifications and Details of the Town of Farmville and the NCDOT as applicable in addition to the requirements state herein.

3.2 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.3 IDENTIFICATION

- A. Materials and their installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tapes directly over piping and at outside edges of underground structures.
 - 1. Use detectable warning tape over nonferrous piping and over edges of underground structures. Locate 6 inches to 24 inches below finished grade, directly over piping.

3.4 SEWERAGE PIPING APPLICATIONS

- A. General: Include watertight joints.
- B. Refer to Part 2 of this Section for detailed specifications for pipe and fitting products. Refer to the drawings type of pipe to be installed.

3.5 INSTALLATION, GENERAL

- A. General Locations and Arrangements: Drawings (plans and details) indicate the general location and arrangement of underground sewerage piping. Location and arrangement of piping layout take into account many design considerations. Install piping as indicated, to extent practical.
- B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's recommendations for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.
- C. Use proper size increasers, reducers, and couplings, where different sizes or materials of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited.
- D. Install gravity-flow-systems piping at constant slope between points and elevations indicated. Install straight piping runs at constant slope, not less than that specified, where slope is not indicated.

- E. Extend gravity sewerage piping and connect to building's sanitary drains, of sizes and in locations indicated. Terminate piping as indicated.
- F. Install gravity sewerage piping pitched down in direction of flow, at minimum and cover as indicated.
- G. Tunneling: Install pipe under streets or other obstructions, that cannot be disturbed, by tunneling, jacking, or a combination of both.
- H. PVC Sewer Service Pipe shall be installed at no less than 4-ft of cover and shall be installed with 4-in minimum stone bedding extended to the springline. PVC sewer service pipe installed with greater than 8-ft of cover shall be bedded on 6-in of stone extended above the pipe crown.
 - 1. Ductile iron pipe shall be used for sanitary sewer services with less than 4-ft of cover or in excess of 20-ft of cover.

3.6 PIPE JOINT CONSTRUCTION AND INSTALLATION

- A. General: Join and install pipe and fittings according to the following.
- B. Ductile-Iron Pipe with Ductile-Iron or Cast-Iron Fittings: With push-on-joint, rubber gaskets according to AWWA C600.
- D. Polyvinyl Chloride (PVC) Plastic Pipe and Fittings: Installation of PVC pipe shall follow the recommendations of ASTM D-2321 "Underground Installation of Thermoplastic Pipe for Sewers and other Gravity-Flow Applications". For PVC pipe installation, bedding and embedment material shall be Class I, typically No. 67 or No. 78 washed stone. Bedding and embedment materials for PVC gravity sewers other than No. 67 or No. 78 washed stone shall be approved by the Town of Farmville prior to use.
 - 1. Typical Bedding and Embedment for SDR35 PVC Gravity Sewers, 4-ft to 14-ft in Depth: Bedding shall consist of minimum 4-inches of No. 67 or No. 78 stone installed under the pipe extending up to the springline. Bedding and embedment shall be compacted to 95% standard proctor density. Careful attention shall be placed on compacting embedment under the haunches of the pipe to prevent any potential voids.
 - 2. Typical Bedding and Embedment for SDR26 PVC Gravity Sewers, 14-ft to 30-ft in Depth: Bedding shall consist of minimum 6-inches of No. 67 or No. 78 stone installed under the pipe extending 6-inches above the crown of the pipe. Bedding and embedment shall be compacted to 95% standard proctor density. Careful attention shall be placed on compacting embedment under the haunches to prevent any potential voids.
 - 3. The bedding and embedment materials shall be in accordance with ASTM D-2321. The embedment materials shall be installed from trench wall to trench wall.
 - 4. The maximum allowable deflection after installation shall BE LESS THAN 5% for PVC pipe.

3.7 MANHOLE ADJUSTMENT

- A. Re-set tops of frames and covers flush with finished surface where manholes occur in pavements. Set tops 3 inches above finished surface elsewhere, except where otherwise indicated.

- B. All manholes in roadways shall be encased in a 3,000-psi concrete collar beneath the asphalt.

3.8 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Sewer cleanouts located in paved areas, which bear vehicle loading, must have ductile iron risers, ductile iron fittings and traffic rated cast iron cover assembly.
- B. Set cleanout frames and covers in earth in a cast-in-place concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding earth grade. Precast cleanout collars shall not be used.
- C. Set cleanout frames and covers in concrete paving with tops flush with surface of paving.

3.9 FIELD QUALITY CONTROL – GRAVITY SEWER SERVICE LINE

- A. Visual Testing and Observation
 - 1. All materials used must be approved by the Inspector prior to installation. Rejected materials shall be immediately removed from the job.
 - 2. Gravity sanitary sewer lines shall be clean and free from obstructions, and shall be visually inspected from every manhole. Lines which do not exhibit a true line and grade or which have structural defects shall be corrected. Sanitary sewer service connections shall be visually inspected prior to backfilling.
- B. Air Testing: Low-pressure air testing in accordance with ASTM F1417 shall be performed on all sewer service lines from the building cleanout to the connection to the public main.
 - 1. Plugs shall be installed at each end to seal off the test section. The line will be pressurized with a single hose and monitored by a separate hose connection from the plug.
 - 2. Air then shall be slowly introduced into the sealed line until the internal air pressure reaches 4.0 psig. The air pressure shall then be allowed to stabilize for a minimum of 2 minutes at no less than 3.5 psig (plus groundwater pressure, if any).
 - 3. When the pressure reaches 3.5, the pressure shall be observed for 5-minutes. A pressure loss of less ½-psi in 5-minutes is deemed acceptable.
 - 4. If the section fails to meet these requirements, the source of leakage shall be repaired and the pipe section re-inspected
 - 5. The Inspector may require that an infiltration test be performed that shall not exceed 100 GPD/inch/mile.
- C. Video Assessment and Cleaning
 - 1. As a final measure required for acceptance, the Contractor shall clean and televise all newly installed sewer lines prior to acceptance.
 - 2. Throughout shooting, the camera shall be panned and tilted for a complete view of the pipe. Lighting shall be adequate to view the entire sewer pipe from beginning to end.
 - 3. The video inspection shall be submitted to the Architect on a CD.
 - 4. The camera shall be advanced at a uniform rate that allows a full and thorough inspection of the new sewer line. The camera shall be a color, pan and tilt camera. The picture quality and resolution shall be acceptable and sufficient to allow a complete inspection with no lapses in coverage. The length of the sewer line shall be measured and recorded

- on the video screen. The distance counter shall be calibrated before shooting the inspection video.
5. The Contractor shall clean the sewer lines ahead of video inspection with a high-velocity water jet. All construction debris shall be collected in the downstream manhole and shall not be released into the sewer system.

END OF SECTION 333000

SECTION 334000 - SITE STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including the General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes site drainage systems outside the building. Systems include the following:
 - 1. Storm drainage.
 - 2. Foundation drainage connections outside of building.
 - 3. Roof drainage connections outside of building.
- B. Related Sections: The following Sections contain requirements that relate to this Section.
 - 1. Division 31 Section "Earth Moving."
 - 2. Division 31 Section "Sediment and Erosion Controls."
 - 3. Division 3 Section "Cast-In-Place Concrete."
 - 4. Division 15 Sections for storm drainage inside the building.

1.3 DEFINITIONS

- A. Drainage Piping: System of pipe, fittings, and appurtenances for gravity flow of storm drainage.

1.4 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. As-Built Survey / Record drawings of installed drainage system piping and basins and all stormwater management devices (ponds, wetlands, bio-retention areas). Survey shall be submitted at least 30-days prior to the project's substantial completion.

1.5 QUALITY ASSURANCE

- A. Environmental Agency Compliance: Comply with regulations pertaining to storm drainage systems.
- B. Utility Compliance: Comply with regulations pertaining to storm drainage systems.
- C. Product Options: Drawings indicate sizes, profiles, connections, and dimensional requirements of system components and are based on specific manufacturer types indicated. Other manufacturers' products with equal performance characteristics may be considered. Refer to Division 1 Section "Products."

- D. Perform As-Built Survey of installed drainage system piping and basins and all stormwater management devices (ponds, wetlands, bio-retention areas). As-built survey shall be signed and seal by a NC Professional Land Surveyor and shall include the following:
 - 1. All inlet, junction box and manhole locations with no less than two primary reference dimensions from permanent above grade features.
 - 2. As-built rims and inverts noted.
 - 3. Pipe materials and sizes, plus slopes and distances between structures.
 - 4. As-built dimensions for installed riprap dissipater pads.
 - 5. Topography of embankments and interiors of drained stormwater management ponds, wetlands and bio-retention cells. Topography shall include all survey point elevations.
 - 6. Detailed as-built dimensions and elevations of stormwater management device outlet structures, weirs, orifices, and outlet pipes.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic structures in direct sunlight.
- B. Do not store plastic pipe or fittings in direct sunlight.
- C. Protect pipe, pipe fittings, and seals from dirt and damage.

1.7 PROJECT CONDITIONS

- A. Site Information: Perform site survey, research public utility records, and verify existing utility locations.
- B. Locate existing structures and piping to be closed and abandoned.
- C. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted under the following conditions and then only after arranging to provide acceptable temporary utility services.
 - 1. Notify Architect not less than 48 hours in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without receiving Architect's written permission.

1.8 SEQUENCING AND SCHEDULING

- A. Coordinate storm drainage system connections to utility company's storm sewer.
- B. Coordinate storm drainage system connections to existing on-site storm sewer.
- C. Coordinate with interior building drainage systems.
- D. Coordinate with other utility work.

PART 2 - PRODUCTS

2.1 PIPES AND FITTINGS

- A. General: Refer to plans for specific pipe material applications.

- B. Ductile-Iron Pipe: ANSI/AWWA C150/A21.50 and C151/A21.51, minimum pressure class 250.
 - 1. Lining: AWWA C104, cement mortar, coal tar epoxy lined.
 - 2. Gaskets, Glands, and Bolts and Nuts: AWWA C111.
 - 3. Push-On-Joint-Type Pipe: AWWA C111, rubber gaskets.
 - 4. Coating: AWWA C151, bituminous coating.
- C. Polyvinyl Chloride (PVC) Sewer Pipe and Fittings: ASTM D-1785, SCH 40 PVC for solvent-cemented or gasketed joints.
 - 1. Primer: ASTM F 656.
 - 2. Solvent Cement: ASTM D 2564.
 - 3. Gaskets: ASTM F 477, elastomeric seal.
- D. Reinforced-Concrete Sewer Pipe and Flared End Sections: ASTM C 76, Class III.
 - 1. Standard Joints: Plastic cement putty seal meeting ASTM C990 and Federal Specification SS-S-00210.
 - 2. Watertight Joints: O-ring rubber gasket meeting ASTM C-443 with external sealer wrap that is at least 12 inches wide and covers the full circumference of the joint.
 - a. External wrap shall be ConWrap CS-212 from Concrete Sealants, Inc., EZ-Wrap form Press-Seal Gasket Corp., Seal Wrap from Mar-Mac Manufacturing or approved equal. Cover external joint sealer with a 3 foot strip of filter fabric meeting NCDOT Type 4 Engineering Fabrics.
 - b. Watertight joints shall be provided at outlet pipes that penetrate pond embankments and other locations specified on the drawings.
- E. High Density Polyethylene (HDPE) Pipe and Fittings: AASHTO M252, M294, MP6, or MP7. Dual-wall with smooth interior and corrugated exterior. All sizes shall conform to the AASHTO classification Type S or D. N-12 or N-12HC by ADS or approved equal.
 - 1. Watertight Joints: Watertight per ASTM D3212, AASHTO M294, MP6 or MP7, bell and spigot, rubber gasket, ASTM F477.
 - 2. Fittings: AASHTO M252, M294, MP6 or MP7, welded on the interior and exterior at all junctions. Only fittings supplied or recommended by the pipe manufacturer shall be used.

2.2 STORM SUB-DRAIN AND FOUNDATION DRAIN PIPING

- A. Storm Sub-Drain Pipe and Fittings: SCH 40 PVC or dual-wall, smooth interior HDPE as specified above, with ½-in drilled perforations. Minimum 4-inch diameter unless otherwise indicated on the drawings. Non perforated pipe shall be used outside of area to be drained to connect sub-drains to drainage inlets.
- B. Filter Fabric: Woven geotextile Drainage (Filter) Fabric as specified in Division 31 Section “Earth Moving.”

2.3 SPECIAL PIPE COUPLINGS AND FITTINGS

- A. Connection from roof downspout to underground storm pipe.
 - 1. Vertical stainless-steel downspout adapter with sch. 40 PVC pipe outlet sized to fit over downspout and underground piping. Adapter shall have a self-cleaning debris trap consisting of a hinged cover and removable debris screen. Powder-coat color to be selected by Architect from manufacturer's full range of colors. As manufactured by Piedmont Pipe Construction.

2.4 DRAINAGE INLETS

- A. Catch Basins and Drop Inlets: Brick and mortar, of depth, shape, and dimensions indicated. Precast concrete basins may be used in lieu of brick upon approval by the Architect. Knock-out waffle boxes shall not be used. All structures shall be designed to withstand AASHTO H-20 loads.
 - 1. Base, Channel, and Bench: Concrete.
 - 2. Wall: ASTM C 32, Grade MS, clay brick masonry units.
 - a. Option: ASTM C 55, Grade S-II, solid concrete brick masonry units may be used instead of clay brick.
 - 3. Mortar: ASTM C 270, Type S, using ASTM C 150, Type I, portland cement.
- B. Frames and Grates: ASTM A48, Class 35B, cast iron, H-20 loading. Include flat grate with small square or short-slotted drainage openings as indicated on the drawings. Provide grate with openings compliant with ADA standards when located within sidewalk or other pedestrian walking areas or where specifically indicated on drawings.
- C. Catch Basin Hood Casting: ASTM A48, Class 35B, cast iron, H-20 loading.
- D. In-Line Drains: 12-inch square top drain designed to be attached with a watertight connection to vertical HDPE or PVC pipe, ductile iron slotted surface grate, watertight pipe adapters. Grates shall be ADA compliant, pedestrian-type where set in pavement or sidewalk. Grates shall be dome-type where set in mulched areas.

2.5 TRENCH DRAINS

- A. Description, General: Modular system of precast, polymer-concrete channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling. Include number of units required to form total lengths indicated.
 - 1. Channel Sections: Interlocking-joint, precast, modular units with end caps. Include 8-inch minimum inside width and deep, rounded bottom, with built-in invert slope of 0.5 percent minimum and with outlets in number, sizes, and locations indicated. Include extension sections necessary for required depth. ACO POverDrain S200K or approved equal.
 - 2. Ductile Iron Grates with manufacturer's designation "heavy-duty," 3,400-psi min. loading, with slots that fit recesses in channels. ACO S200K Slotted Iron or approved equal.
 - 3. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.

2.6 MANHOLES

- A. Precast Concrete Storm Drainage Manholes: ASTM C-478 precast reinforced concrete, eccentric cone. All structures shall be designed to withstand AASHTO H-20 loads.
 - 1. Base, Channel, and Bench: Concrete.
 - 2. Joint: Preformed flexible plastic gaskets complying with Fed. Spec. SS-S-210A.
 - 3. Size: As required to accommodate proposed pipes indicated on the drawings, 4-ft diameter minimum.
- B. Frames and Covers: ASTM A48, Class 35B, heavy-duty cast iron. Include flat, round grate with 1-1/2" wide slotted drainage openings with a minimum total open area of 150-sq.in.

2.7 CLEANOUTS

- A. Description: ASME A112.36.2M, round, cast-iron housing with clamping device and round, secured, scoriated, cast-iron cover. Include cast-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug. Cleanout shall be rated for "heavy duty" top-loading classifications.
 - 1. Cleanout Box: Cleanouts located in paved areas subject to vehicular traffic shall be protected by an 8-in diameter, ductile-iron cleanout box. 'STORM' marking shall be cast into the lid.

2.8 STORMWATER CONTROL MEASURE OUTLET STRUCTURE

- A. Concrete Outlet Structure: Pre-Cast, solid wall, 4,000-psi, reinforced concrete designed to meet H-20 loading of depth, shape, and dimensions indicated. Waffle boxes are not acceptable.
 - 1. Base and ballast in-fill: Concrete.
 - 2. Wall: Solid, reinforced concrete. Provide exterior brick veneer if indicated on drawings.
 - a. Brick: ASTM C 32, Grade MS, clay brick units.
 - b. Mortar: ASTM C 270, Type S, using ASTM C 150, Type I, portland cement.
 - 3. Joints: Pre-Cast structures shall have no section joints below permanent pool elevation.
 - 4. Grout: ASTM C1107, non-shrink, hydraulic cement grout.
- C. Pipe Connectors: ASTM C 923, resilient, water-tight flexible connector, of size required, for each pipe connecting to outlet structure.
 - 1. Following installation of pipe connector, grout voids between pipe, connector and outlets structure with non-shrink hydraulic cement grout on inside and outside of outlet structure. Finish grout flush with structure wall.
- D. Frames and Grates: ASTM A48, Class 35B, cast iron, H-20 loading. Include flat grate with slotted drainage openings as indicated on the drawings.
- E. Trash Rack: Aluminum with separate frame a grate with access hatch as detailed on the drawings. Trash racks shall be as manufactured by Trashracks.com or approved equal.

- F. Trash Baffle: Fabricated from 7-gauge Type 316 aluminum sheet and fastened with all stainless steel fasteners.

2.9 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318, ACI 350R, and the following:
 - 1. Cement: ASTM C 150, Type I, 3,000-psi.
 - 2. Fine Aggregate: ASTM C 33, sand.
 - 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 - 4. Water: Potable.
- B. Structures: Portland-cement design mix, 4000 psi minimum, with 0.45 maximum water-cement ratio.
 - 1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
 - 2. Reinforcement Bars: ASTM A 615, Grade 60, deformed steel.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."

3.2 SPECIAL PIPE COUPLING AND FITTING APPLICATIONS

- A. Special Pipe Couplings: Use where indicated and where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.

3.3 INSTALLATION, GENERAL

- A. General Locations and Arrangements: Drawings (plans and details) indicate the general location and arrangement of underground drainage systems piping. Location and arrangement of piping layout take into account many design considerations. Install piping as indicated, to extent practical. Refer to drawings for material and structure types for specific applications.
- B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's recommendations for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.
- C. Use proper size increasers, reducers, and couplings, where different sizes or materials of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited.
- D. Extend drainage piping and connect to building's storm drains, of sizes and in locations indicated. Terminate piping as indicated.
- E. Install drainage piping pitched down in direction of flow, at minimum slope of 1 percent and 36-inch minimum cover, except where otherwise indicated.

F. Polyvinyl Chloride (PVC) Plastic Pipe and Fittings: As follows:

1. Join solvent-cement-joint pipe and fittings with solvent cement according to ASTM D 2855 and ASTM F 402.
2. Join pipe and gasketed fittings with elastomeric seals according to ASTM D 2321.
3. Join profile sewer pipe and ribbed drain pipe and gasketed fittings with elastomeric seals according to ASTM D 2321 and manufacturer's written instruction.
4. Install according to ASTM D 2321.

G. Install HDPE pipe in accordance with ASTM D2321 with the exception that minimum cover in trafficked areas shall be 12-inches.

1. Slightly scarify and grade the trench base to provide a uniform trench bottom. Before installing pipe, bring bedding material or trench bottom to grade along the entire length of the pipe. For 42" pipe and larger, shallow bell holes shall be provided.
2. Trench width shall be wide enough to accommodate compaction equipment. Refer the manufacturer's recommendations. Pipe backfill to springline shall be compacted to 95% Standard Proctor density regardless of pipe location.
3. Excessive groundwater necessitates dewatering. Pipe will float in standing water, requiring immediate haunching and initial backfill to hold line and grade.
4. Join pipe per manufacturer's instructions.

H. Join piping made of different materials or dimensions with couplings made for this application. Use couplings that are compatible with and fit both systems' materials and dimensions.

I. Install stormwater control measure outlet pipes through embankments with concrete support cradle from the bottom of the pipe trench to the springline of the pipe.

3.4 CATCH BASIN AND DROP INLET INSTALLATION

- A. Construct inlets to sizes and shapes indicated.
- B. Set frames and grates to elevations indicated.
- C. Install prefabricated area drains per manufacturer's instructions.

3.5 TRENCH DRAIN INSTALLATION

- A. Install trench drains in accordance with the manufacturer's written instructions and as indicated on the drawings. Install surrounding concrete with surfaces with 1/4" per foot slopes to rim of grate.
- B. Extend drain pipe from in-line catch basin to large capacity site storm drainage system and install hardware mesh rodent screen over outlet of drain pipe.
- C. Protect trench drain with non-woven filter fabric under grate during construction. Ensure trench and entire length of outlet pipe are clear of sediment and debris at completion of construction.

3.6 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Install piping so cleanouts open in direction of flow in sewer pipe.
- B. In Paved Areas: Cleanouts shall be installed within a protective cleanout box set flush with surface of paving.
- C. In Non-Paved Areas: Set cleanout tops 1 inch above surrounding earth grade.

3.7 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

- A. Abandoned Piping: Close open ends of abandoned underground piping that is indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either of the following procedures:
 - 1. Close open ends of piping with at least 8-inch-thick brick masonry bulkheads.
 - 2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
- B. Abandoned Structures: Excavate around structure as required and use either of the following procedures:
 - 1. Remove structure and close open ends of remaining piping.
 - 2. Backfill to grade according to Division 2 Section "Earthwork."

3.8 FIELD QUALITY CONTROL

- A. Clear interior of piping and structures of dirt and superfluous material as the work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.
 - 1. In large, accessible piping, brushes and brooms may be used for cleaning.
 - 2. Place plug in end of incomplete piping at end of day and whenever work stops.
 - 3. Flush piping between manholes and other structures, if required by authorities having jurisdiction, to remove collected debris.
- B. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of the Project.
 - 1. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visual between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of a ball or cylinder of a size not less than 92.5 percent of piping diameter.
 - c. Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 - 2. Replace defective piping using new materials and repeat inspections until defects are within allowances specified.
 - 3. Reinspect and repeat procedure until results are satisfactory.

- C. All HDPE pipe and fittings 12-inch in diameter and greater shall be inspected by the pipe supplier/manufacturer following delivery to the construction site for damage caused during transit. Damaged or defective materials shall be removed from the site. A record of this inspection(s) shall be submitted to the Architect. Contractor shall supply documentation of experience in the installation of HDPE storm drainage pipe or shall provide for installation supervision by the supplier/manufacturer.
- D. Test new piping systems and parts of existing systems that have been altered, extended, or repaired for leaks and defects.
 - 1. Do not enclose, cover, or put into service before inspection and approval.
 - 2. Test completed piping systems according to authorities having jurisdiction.
 - 3. Schedule tests, and their inspections by authorities having jurisdiction, with at least 24 hours' advance notice.
 - 4. Submit separate reports for each test.

END OF SECTION 334000

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